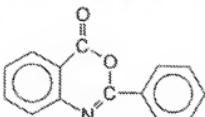


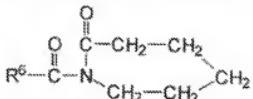
wherein R1 is H, alkyl, alkaryl, aryl, arylalkyl, and wherein R2, R3, R4, and R5 may be the same or different substituents selected from H, halogen, alkyl, alkenyl, aryl, hydroxyl, alkoxy, amino, alkyl amino, COOR⁶ (wherein R⁶ is H or an alkyl group) and carbonyl functions.

A preferred activator of the benzoxazin-type is:



When the activators are used, optimum surface bleaching performance is obtained with washing solutions wherein the pH of such solution is between about 8.5 and 10.5 and preferably between 9.5 and 10.5 in order to facilitate the perhydrolysis reaction. Such pH can be obtained with substances commonly known as buffering agents, which are optional components of the bleaching systems herein.

- N-Acyl Caprolactam Bleach Activators - The N-acyl caprolactam bleach activators of type c) employed in the present invention have the formula:



wherein R⁶ is H or an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to 12 carbons. Caprolactam activators wherein the R⁶ moiety contains at least about 6, preferably from 6 to about 12, carbon atoms provide hydrophobic bleaching which affords nucleophilic and body soil clean-up, as noted above. Caprolactam activators wherein R⁶ comprises from 1 to about 6 carbon atoms provide hydrophilic bleaching species which are particularly efficient for bleaching beverage stains. Mixtures of hydrophobic and hydrophilic caprolactams, typically at weight ratios of 1:5 to 5:1, preferably 1:1, can be used herein for mixed stain removal benefits.

Highly preferred N-acyl caprolactams are selected from the group consisting of benzoyl caprolactam, octanoyl caprolactam, nonanoyl caprolactam, 3,5,5-

trimethylhexaenoyl caprolactam, decanoyl caprolactam, undecenoyl caprolactam, and mixtures thereof. Methods for making N-acyl caprolactams are well known in the art.

Contrary to the teachings of U.S. Pat. 4,545,784, the bleach activator is preferably not absorbed onto the peroxygen bleaching compound. To do so in the presence of other organic detergents ingredients could cause safety problems.

The bleach activators of type a), b) or c) will comprise at least about 0.01%, preferably from about 0.1%, more preferably from about 1%, most preferably from about 3% to about 50%, preferably to about 30%, more preferably to about 15%, still more preferably to about 10%, most preferably to about 8% by weight of bleaching system or bleaching composition.

The preferred amido-derived and caprolactam bleach activators herein can also be used in combination with rubber-safe, enzyme-safe, hydrophilic activators such as TAED, typically at weight ratios of amido-derived or caprolactam activators:TAED in the range of 1:5 to 5:1, preferably about 1:1.

Highly preferred bleach activators are selected from the group consisting of tetraacetyl ethylene diamine (TAED), benzoylcaprolactam (BzCL), 4-nitrobenzoylcaprolactam, 3-chlorobenzoylcaprolactam, benzyloxybenzenesulphonate (BOBS), nonanoyloxybenzenesulphonate (NOBS), phenyl benzoate (PhBz), decanoyloxybenzenesulphonate (C₁₀-OBS), benzoylvalerolactam (BZVL), octanoyloxybenzenesulphonate (C₈-OBS), perhydrolyzable esters and mixtures thereof, most preferably benzoylcaprolactam and benzoylvalerolactam. Particularly preferred bleach activators in the pH range from about 8 to about 9.5 are those selected having an OBS or VL leaving group.

Additional preferred bleach activators are those described in U.S. 5,698,504 Christie et al., issued December 16, 1997; U.S. 5,695,679 Christie et al. issued December 9, 1997; U.S. 5,686,401 Willey et al., issued November 11, 1997; U.S. 5,686,014 Hartshorn et al., issued November 11, 1997; U.S. 5,405,412 Willey et al., issued April 11, 1995; U.S. 5,405,413 Willey et al., issued April 11, 1995; U.S. 5,130,045 Mitchel et al., issued July 14, 1992; and U.S. 4,412,934 Chung et al., issued November 1, 1983, and copending patent applications U. S. Serial Nos. 08/709,072, 08/064,564, all of which are incorporated herein by reference.

Preferred hydrophobic bleach activators include, but are not limited to, nonanoyloxybenzenesulphonate (NOBS), 4-[N-(nonaoyl) amino hexanoyloxy]-benzene sulfonate sodium salt (NACA-OBS) an example of which is described in U.S. Patent No. 5,523,434, dodecanoyloxybenzenesulphonate (LOBS or C₁₂-OBS), 10-undecenoyloxybenzenesulfonate (UDOBS or C₁₁-OBS with unsaturation in the 10 position), and decanoyloxybenzoic acid (DOBA).

Quaternary substituted bleach activators may also be included. The present cleaning compositions preferably comprise a quaternary substituted bleach activator (QSBA) or a quaternary substituted peracid (QSP); more preferably, the former. Preferred QSBA structures are further described in U.S. 5,686,015 Willey et al., issued November 11, 1997; U.S. 5,654,421 Taylor et al., issued August 5, 1997; U.S. 5,460,747 Gosselink et al., issued October 24, 1995; U.S. 5,584,888 Miracle et al., issued December 17, 1996; and U.S. 5,578,136 Taylor et al., issued November 26, 1996; all of which are incorporated herein by reference.

Highly preferred bleach activators useful herein are amide-substituted as described in U.S. 5,698,504, U.S. 5,695,679, and U.S. 5,686,014 each of which are cited herein above. Preferred examples of such bleach activators include: (6-octanamidocaproyl)oxybenzenesulfonate, (6-nonanamidocaproyl)oxybenzenesulfonate, (6-decanamidocaproyl)oxybenzenesulfonate and mixtures thereof.

Other useful activators, disclosed in U.S. 5,698,504, U.S. 5,695,679, U.S. 5,686,014 each of which is cited herein above and U.S. 4,966,723 Hodge et al., issued October 30, 1990, include benzoxazin-type activators, such as a C₆H₅ ring to which is fused in the 1,2-positions a moiety $-C(O)OC(R^1)=N-$.

Depending on the activator and precise application, good bleaching results can be obtained from bleaching systems having with in-use pH of from about 6 to about 13, preferably from about 9.0 to about 10.5. Typically, for example, activators with electron-withdrawing moieties are used for near-neutral or sub-neutral pH ranges. Alkalies and buffering agents can be used to secure such pH.

Acyl lactam activators, as described in U.S. 5,698,504, U.S. 5,695,679 and U.S. 5,686,014, each of which is cited herein above, are very useful herein, especially the acyl caprolactams (see for example WO 94-28102 A) and acyl valerolactams (see U.S. 5,503,639 Willey et al., issued April 2, 1996 incorporated herein by reference).

The bleaching mechanism generally, and the surface bleaching mechanism in particular, are not completely understood. However, it is generally believed that the bleach activator undergoes nucleophilic attack by a perhydroxide anion, which is generated from the hydrogen peroxide evolved by the peroxygen bleach, to form a peroxycarboxylic acid. This reaction is commonly referred to as perhydrolysis.

When the activators are used, optimum surface bleaching performance is obtained with washing solutions wherein the pH of such solution is between about 8.5 and 10.5 and preferably between 9.5 and 10.5 in order to facilitate the perhydrolysis reaction. Such pH can be obtained with substances commonly known as buffering agents, which are optional components of the bleaching systems herein.

(ii) The Peroxygen Bleaching Compound

The peroxygen bleaching systems useful herein are those capable of yielding hydrogen peroxide in an aqueous liquor. These compounds are well known in the art and include hydrogen peroxide and the alkali metal peroxides, organic peroxide bleaching compounds such as urea peroxide, and inorganic persalt bleaching compounds, such as the alkali metal perborates, percarbonates, perphosphates, and the like. Mixtures of two or more such bleaching compounds can also be used, if desired.

Hydrogen peroxide sources are described in detail in the herein incorporated Kirk Othmer's Encyclopedia of Chemical Technology, 4th Ed (1992, John Wiley & Sons), Vol. 4, pp. 271-300 "Bleaching Agents (Survey)", and include the various forms of sodium perborate and sodium percarbonate, including various coated and modified forms.

Preferred peroxygen bleaching compounds include sodium perborate, commercially available in the form of mono-, tri-, and tetra-hydrate, sodium pyrophosphate peroxyhydrate, urea peroxyhydrate, sodium percarbonate, and sodium peroxide. Particularly preferred are sodium perborate tetrahydrate, sodium perborate monohydrate and sodium percarbonate. Percarbonate is especially preferred because it is very stable during storage and yet still dissolves very quickly in the bleaching liquor. It is believed that such rapid dissolution results in the formation of higher levels of percarboxylic acid and, thus, enhanced surface bleaching performance.

Highly preferred percarbonate can be in uncoated or coated form. The average particle size of uncoated percarbonate ranges from about 400 to about 1200 microns, most preferably from about 400 to about 600 microns. If coated percarbonate is used, the preferred coating materials include mixtures of carbonate and sulphate, silicate, borosilicate, or fatty carboxylic acids.

The peroxygen bleaching compound will comprise at least about 0.1%, preferably from about 1% to about 75%, more preferably from about 3% to about 40%, most preferably from about 3% to about 25%, by weight of bleaching system or bleaching composition.

The weight ratio of bleach activator to peroxygen bleaching compound in the bleaching system typically ranges from about 2:1 to 1:5. Preferred ratios range from about 1:1 to about 1:3.

The mole ratio of peroxygen bleaching compound (as AvO) to bleach activator in the present invention generally ranges from at least 1:1, preferably from at least 1.5:1, most preferably from at least 2:1, to about 20:1, preferably to about 10:1, more preferably to about 3:1. Preferably, the bleaching compositions herein comprise from about 0.5 to about 20, most preferably from about 1 to about 10, wt.% of the peroxygen bleaching compound.

The bleach activator/bleaching compound systems herein are useful per se as bleaches. However, such bleaching systems are especially useful in compositions which can comprise various detergent adjuncts such as surfactants, builders and the like.

Bleach Catalysts - The compositions herein may further comprise one or more bleach catalysts. Preferred bleach catalysts are zwitterionic bleach catalysts, which are described in U.S. Patent Nos. 5,576,282 and 5,817,614 (especially 3-(3,4-dihydroisoquinolinium) propane sulfonate. Other bleach catalysts include cationic bleach catalysts are described in U.S. Patent Nos. 5,360,569, 5,442,066, 5,478,357, 5,370,826, 5,482,515, 5,550,256, and WO 95/13351, WO 95/13352, and WO 95/13353.

BLEACHING COMPOSITIONS

The bleaching compositions of the present invention also comprise, in addition to one or more protease variants and one or more bleaching agents described hereinbefore, one or more cleaning adjunct materials, preferably compatible with the protease variant(s) and bleaching agent(s). The term "compatible", as used herein, means the bleaching composition materials do not reduce the proteolytic activity of the protease enzyme to such an extent that the protease is not effective as desired during normal use situations. The term "cleaning adjunct materials", as used herein, means any liquid, solid or gaseous material selected for the particular type of bleaching composition desired and the form of the product (e.g., liquid; granule; powder; bar; paste; spray; tablet; gel; foam composition), which materials are also preferably compatible with the protease enzyme(s) and bleaching agent(s) used in the composition. Granular compositions can also be in "compact" form and the liquid compositions can also be in a "concentrated" form.

The specific selection of cleaning adjunct materials are readily made by considering the surface, item or fabric to be cleaned, and the desired form of the composition for the cleaning conditions during use (e.g., through the wash detergent use). Examples of suitable cleaning adjunct materials include, but are not limited to, surfactants, builders, bleaches, bleach activators, bleach catalysts, other enzymes, enzymic stabilizing systems, chelants, optical brighteners, soil release polymers, dye transfer agents, dispersants, suds suppressors, dyes, perfumes, colorants, filler salts, hydrotropes, photoactivators, fluorescers, fabric conditioners, hydrolyzable surfactants, preservatives, anti-oxidants, anti-shrinkage agents, anti-wrinkle agents, germicides, fungicides, color speckles, silvercare, anti-tarnish and/or anti-corrosion agents, alkafinity sources, solubilizing agents, carriers, processing aids, pigments and pH control agents as described in U.S. Patent Nos. 5,705,464, 5,710,115, 5,698,504, 5,695,679, 5,686,014 and 5,646,101. Specific bleaching composition materials are exemplified in detail hereinafter.

If the cleaning adjunct materials are not compatible with the protease variant(s) in the bleaching compositions, then suitable methods of keeping the cleaning adjunct

materials and the protease variant(s) separate (not in contact with each other) until combination of the two components is appropriate can be used. Suitable methods can be any method known in the art, such as gelcaps, encapsulation, tablets, physical separation, etc.

Preferably, an effective amount of one or more protease variants described above are included in compositions useful for cleaning a variety of surfaces in need of proteinaceous stain removal. Such bleaching compositions include detergent compositions for cleaning hard surfaces, unlimited in form (e.g., liquid, granular, paste, foam, spray, etc.); detergent compositions for cleaning fabrics, unlimited in form (e.g., granular, liquid, bar formulations, etc.); dishwashing compositions (unlimited in form and including both granular and liquid automatic dishwashing); oral bleaching compositions, unlimited in form (e.g., dentifrice, toothpaste and mouthwash formulations); and denture bleaching compositions, unlimited in form (e.g., liquid, tablet).

The fabric bleaching compositions of the present invention are mainly intended to be used in the wash cycle of a washing machine; however, other uses can be contemplated, such as pretreatment product for heavily-soiled fabrics, or soaking product; the use is not necessarily limited to the washing-machine context, and the compositions of the present invention can be used alone or in combination with compatible handwash compositions.

As used herein, "effective amount of protease variant" refers to the quantity of protease variant described hereinbefore necessary to achieve the enzymatic activity necessary in the specific bleaching composition. Such effective amounts are readily ascertained by one of ordinary skill in the art and is based on many factors, such as the particular variant used, the cleaning application, the specific composition of the bleaching composition, and whether a liquid or dry (e.g., granular, bar) composition is required, and the like.

Preferably the bleaching compositions comprise from about 0.0001% to about 10% of one or more protease variants of the present invention, more preferably from about 0.001% to about 1%, more preferably still from about 0.001% to about 0.1%. Also preferably the protease variant of the present invention is present in the compositions in an amount sufficient to provide a ratio of mg of active protease per 100 grams of composition to ppm theoretical Available O₂ ("AvO₂") from any peroxyacid in the wash liquor, referred to herein as the Enzyme to Bleach ratio (E/B ratio), ranging from about 1:1 to about 20:1. Several examples of various bleaching compositions wherein the protease variants of the present invention may be employed are discussed in further detail below. Also, the bleaching compositions may include from about 1% to about 99.9% by weight of the composition of the cleaning adjunct materials.

As used herein, "non-fabric bleaching compositions" include hard surface bleaching compositions, dishwashing compositions, oral bleaching compositions, denture bleaching compositions and personal cleansing compositions.

When the bleaching compositions of the present invention are formulated as compositions suitable for use in a laundry machine washing method, the compositions of the present invention preferably contain both a surfactant and a builder compound and additionally one or more cleaning adjunct materials preferably selected from organic polymeric compounds, bleaching agents, additional enzymes, suds suppressors, dispersants, lime-soap dispersants, soil suspension and anti-redeposition agents and corrosion inhibitors. Laundry compositions can also contain softening agents, as additional cleaning adjunct materials.

The compositions of the present invention can also be used as detergent additive products in solid or liquid form. Such additive products are intended to supplement or boost the performance of conventional detergent compositions and can be added at any stage of the cleaning process.

When formulated as compositions for use in manual dishwashing methods the compositions of the invention preferably contain a surfactant and preferably other cleaning adjunct materials selected from organic polymeric compounds, suds enhancing agents, group II metal ions, solvents, hydrotropes and additional enzymes.

If needed the density of the laundry detergent compositions herein ranges from 400 to 1200 g/litre, preferably 500 to 950 g/litre of composition measured at 20°C.

The "compact" form of the bleaching compositions herein is best reflected by density and, in terms of composition, by the amount of inorganic filler salt; inorganic filler salts are conventional ingredients of detergent compositions in powder form; in conventional detergent compositions, the filler salts are present in substantial amounts, typically 17-35% by weight of the total composition. In the compact compositions, the filler salt is present in amounts not exceeding 15% of the total composition, preferably not exceeding 10%, most preferably not exceeding 5% by weight of the composition. The inorganic filler salts, such as meant in the present compositions are selected from the alkali and alkaline-earth-metal salts of sulfates and chlorides. A preferred filler salt is sodium sulfate.

Liquid bleaching compositions according to the present invention can also be in a "concentrated form", in such case, the liquid bleaching compositions according the present invention will contain a lower amount of water, compared to conventional liquid detergents. Typically the water content of the concentrated liquid bleaching composition is preferably less than 40%, more preferably less than 30%, most preferably less than 20% by weight of the bleaching composition.

Cleaning Adjunct Materials

Surfactant System - Detergent surfactants included in the fully-formulated bleaching compositions afforded by the present invention comprises at least 0.01%, preferably at least about 0.1%, more preferably at least about 0.5%, most preferably at least about 1% to about 60%, more preferably to about 35%, most preferably to about 30% by weight of bleaching composition depending upon the particular surfactants used and the desired effects.

The detergent surfactant can be nonionic, anionic, amphoteric, zwitterionic, cationic, semi-polar nonionic, and mixtures thereof, nonlimiting examples of which are disclosed in U.S. Patent Nos. 5,707,950 and 5,576,282. Preferred detergent and bleaching compositions comprise anionic detergent surfactants or mixtures of anionic surfactants with other surfactants, especially nonionic surfactants.

Nonlimiting examples of surfactants useful herein include the conventional C₁₁-C₁₈ alkyl benzene sulfonates and primary, secondary and random alkyl sulfates, the C₁₀-C₁₈ alkyl alkoxy sulfates, the C₁₀-C₁₈ alkyl polyglycosides and their corresponding sulfated polyglycosides, C₁₂-C₁₈ alpha-sulfonated fatty acid esters, C₁₂-C₁₈ alkyl and alkyl phenol alkoxylates (especially ethoxylates and mixed ethoxy/propanoate), C₁₂-C₁₈ betaines and sulfobetaines ("sultaines"), C₁₀-C₁₈ amine oxides, and the like. Other conventional useful surfactants are listed in standard texts.

The surfactant is preferably formulated to be compatible with enzyme components present in the composition. In liquid or gel compositions the surfactant is most preferably formulated such that it promotes, or at least does not degrade, the stability of any enzyme in these compositions.

Nonionic Surfactants - Polyethylene, polypropylene, and polybutylene oxide condensates of alkyl phenols are suitable for use as the nonionic surfactant of the surfactant systems of the present invention, with the polyethylene oxide condensates being preferred. Commercially available nonionic surfactants of this type include IgepalTM CO-630, marketed by the GAF Corporation; and TritonTM X-45, X-114, X-100 and X-102, all marketed by the Rohm & Haas Company. These surfactants are commonly referred to as alkylphenol alkoxylates (e.g., alkyl phenol ethoxylates).

The condensation products of primary and secondary aliphatic alcohols with from about 1 to about 25 moles of ethylene oxide are suitable for use as the nonionic surfactant of the nonionic surfactant systems of the present invention. Examples of commercially available nonionic surfactants of this type include TergitolTM 15-S-9 (the condensation product of C₁₁-C₁₅ linear alcohol with 9 moles ethylene oxide), TergitolTM 24-L-6 NMW (the condensation product of C₁₂-C₁₄ primary alcohol with 6 moles ethylene oxide with a narrow molecular weight distribution), both marketed by Union Carbide Corporation; NeodolTM 45-9 (the condensation product of C₁₄-C₁₅ linear alcohol with 9 moles of

ethylene oxide), NeodolTM 23-3 (the condensation product of C₁₂-C₁₃ linear alcohol with 3.0 moles of ethylene oxide), NeodolTM 45-7 (the condensation product of C₁₄-C₁₅ linear alcohol with 7 moles of ethylene oxide), NeodolTM 45-5 (the condensation product of C₁₄-C₁₅ linear alcohol with 5 moles of ethylene oxide) marketed by Shell Chemical Company, KyroTM EOB (the condensation product of C₁₃-C₁₅ alcohol with 9 moles ethylene oxide), marketed by The Procter & Gamble Company, and Genapol LA O3O or O5O (the condensation product of C₁₂-C₁₄ alcohol with 3 or 5 moles of ethylene oxide) marketed by Hoechst. Preferred range of HLB in these products is from 8-11 and most preferred from 8-10.

Also useful as the nonionic surfactant of the surfactant systems of the present invention are the alkylpolysaccharides disclosed in U.S. Patent No. 4,565,647.

Preferred alkylpolyglycosides have the formula: R²O(C_nH_{2n}O)₄(glycosyl)_x wherein R² is selected from the group consisting of alkyl, alkylphenyl, hydroxyalkyl, hydroxyalkylphenyl, and mixtures thereof in which the alkyl groups contain from about 10 to about 18, preferably from about 12 to about 14, carbon atoms; n is 2 or 3, preferably 2; t is from 0 to about 10, preferably 0; and x is from about 1.3 to about 10, preferably from about 1.3 to about 3, most preferably from about 1.3 to about 2.7.

The condensation products of ethylene oxide with a hydrophobic base formed by the condensation of propylene oxide with propylene glycol are also suitable for use as the additional nonionic surfactant systems of the present invention. Examples of compounds of this type include certain of the commercially-available PlurafacTM LF404 and PluronicTM surfactants, marketed by BASF.

Also suitable for use as the nonionic surfactant of the nonionic surfactant system of the present invention, are the condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylenediamine. Examples of this type of nonionic surfactant include certain of the commercially available TetronicTM compounds, marketed by BASF.

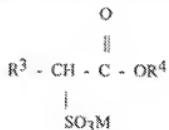
Preferred for use as the nonionic surfactant of the surfactant systems of the present invention are polyethylene oxide condensates of alkyl phenols, condensation products of primary and secondary aliphatic alcohols with from about 1 to about 25 moles of ethylene oxide, alkylpolysaccharides, and mixtures thereof. Most preferred are C₈-C₁₄ alkyl phenol ethoxylates having from 3 to 15 ethoxy groups and C₈-C₁₈ alcohol ethoxylates (preferably C₁₀ avg.) having from 2 to 10 ethoxy groups, and mixtures thereof.

Highly preferred nonionic surfactants are polyhydroxy fatty acid amide surfactants of the formula: R²-C(O)-N(R¹)-Z wherein R¹ is H, or R¹ is C₁₋₄ hydrocarbyl, 2-hydroxy ethyl, 2-hydroxy propyl or a mixture thereof, R² is C₅₋₃₁ hydrocarbyl, and Z is a polyhydroxyhydrocarbyl having a linear hydrocarbyl chain with at least 3 hydroxyls

directly connected to the chain, or an alkoxylated derivative thereof. Preferably, R¹ is methyl, R² is a straight C₁₁₋₁₅ alkyl or C₁₆₋₁₈ alkyl or alkenyl chain such as coconut alkyl or mixtures thereof, and Z is derived from a reducing sugar such as glucose, fructose, maltose, lactose, in a reductive amination reaction.

Anionic Surfactants - Suitable anionic surfactants to be used are linear alkyl benzene sulfonate, alkyl ester sulfonate surfactants including linear esters of C_{8-C₂₀} carboxylic acids (i.e., fatty acids) which are sulfonated with gaseous SO₃ according to "The Journal of the American Oil Chemists Society", 52 (1975), pp. 323-329. Suitable starting materials would include natural fatty substances as derived from tallow, palm oil, etc.

The preferred alkyl ester sulfonate surfactant, especially for laundry applications, comprise alkyl ester sulfonate surfactants of the structural formula :



wherein R³ is a C_{8-C₂₀} hydrocarbyl, preferably an alkyl, or combination thereof, R⁴ is a C_{1-C₆} hydrocarbyl, preferably an alkyl, or combination thereof, and M is a cation which forms a water soluble salt with the alkyl ester sulfonate. Suitable salt-forming cations include metals such as sodium, potassium, and lithium, and substituted or unsubstituted ammonium cations, such as monoethanolamine, diethanolamine, and triethanolamine. Preferably, R³ is C_{10-C₁₆} alkyl, and R⁴ is methyl, ethyl or isopropyl. Especially preferred are the methyl ester sulfonates wherein R³ is C_{10-C₁₆} alkyl.

Other suitable anionic surfactants include the alkyl sulfate surfactants which are water soluble salts or acids of the formula ROSO₃M wherein R preferably is a C_{10-C₂₄} hydrocarbyl, preferably an alkyl or hydroxyalkyl having a C_{10-C₂₀} alkyl component, more preferably a C_{12-C₁₈} alkyl or hydroxyalkyl, and M is H or a cation. Typically, alkyl chains of C_{12-C₁₆} are preferred for lower wash temperatures (e.g. below about 50°C) and C₁₆₋₁₈ alkyl chains are preferred for higher wash temperatures (e.g. above about 50°C).

Other anionic surfactants useful for detergents purposes include salts of soap, C_{8-C₂₂} primary or secondary alkanesulfonates, C_{8-C₂₄} olefinsulfonates, sulfonated polycarboxylic acids prepared by sulfonation of the pyrolyzed product of alkaline earth metal citrates, e.g., as described in British patent specification No. 1,082,179, C_{8-C₂₄} alkyl/polyglycolethersulfates (containing up to 10 moles of ethylene oxide); alkyl glycerol sulfonates, fatty acyl glycerol sulfonates, fatty oleyl glycerol sulfonates, alkyl phenol ethylene oxide ether sulfonates, paraffin sulfonates, alkyl phosphates, isethionates such as the acyl isethionates, N-acyl taurates, alkyl succinamates and sulfosuccinates, monoesters of

sulfosuccinates (especially saturated and unsaturated C₁₂-C₁₈ monoesters) and diesters of sulfosuccinates (especially saturated and unsaturated C₆-C₁₂ diesters), acyl sarcosinates, sulfates of alkylpolysaccharides such as the sulfates of alkylpolyglucoside (the nonionic nonsulfated compounds being described below), branched primary alkyl sulfates, and alkyl polyethoxy carboxylates such as those of the formula RO(CH₂CH₂O)_k-CH₂COO-M⁺ wherein R is a C₈-C₂₂ alkyl, k is an integer from 1 to 10, and M is a soluble salt-forming cation. Resin acids and hydrogenated resin acids are also suitable, such as rosin, hydrogenated rosin, and resin acids and hydrogenated resin acids present in or derived from tall oil.

Further examples are described in "Surface Active Agents and Detergents" (Vol. I and II by Schwartz, Perry and Berch). A variety of such surfactants are also generally disclosed in U.S. Patent 3,929,678, issued December 30, 1975 to Laughlin, et al. at Column 23, line 58 through Column 29, line 23 (herein incorporated by reference).

Highly preferred anionic surfactants include alkyl ethoxylated sulfate surfactants hereof are water soluble salts or acids of the formula RO(A)_mSO₃M wherein R is an unsubstituted C₁₀-C₂₄ alkyl or hydroxyalkyl group having a C₁₀-C₂₄ alkyl component, preferably a C₁₂-C₂₀ alkyl or hydroxyalkyl, more preferably C₁₂-C₁₈ alkyl or hydroxyalkyl, A is an ethoxy or propoxy unit, m is greater than zero, typically between about 0.5 and about 6, more preferably between about 0.5 and about 3, and M is H or a cation which can be, for example, a metal cation (e.g., sodium, potassium, lithium, calcium, magnesium, etc.), ammonium or substituted-ammonium cation. Alkyl ethoxylated sulfates as well as alkyl propoxylated sulfates are contemplated herein. Specific examples of substituted ammonium cations include methyl-, dimethyl, trimethyl-ammonium cations and quaternary ammonium cations such as tetramethyl-ammonium and dimethyl piperidinium cations and those derived from alkylamines such as ethylamine, diethylamine, triethylamine, mixtures thereof, and the like. Exemplary surfactants are C₁₂-C₁₈ alkyl polyethoxylate (1.0) sulfate (C₁₂-C₁₈E(1.0)M), C₁₂-C₁₈ alkyl polyethoxylate (2.25) sulfate (C₁₂-C₁₈E(2.25)M), C₁₂-C₁₈ alkyl polyethoxylate (3.0) sulfate (C₁₂-C₁₈E(3.0)M), and C₁₂-C₁₈ alkyl polyethoxylate (4.0) sulfate (C₁₂-C₁₈E(4.0)M), wherein M is conveniently selected from sodium and potassium.

When included therein, the bleaching compositions of the present invention typically comprise from about 1%, preferably from about 3% to about 40%, preferably about 20% by weight of such anionic surfactants.

Cationic Surfactants - Cationic detergents suitable for use in the bleaching compositions of the present invention are those having one long-chain hydrocarbyl group. Examples of such cationic surfactants include the ammonium surfactants such as alkyltrimethylammonium halogenides, and those surfactants having the

formula: $[R^2(OR^3)^y][R^4(OR^3)^z]_2R^5N+X-$ wherein R^2 is an alkyl or alkyl benzyl group having from about 8 to about 18 carbon atoms in the alkyl chain, each R^3 is selected from the group consisting of - CH_2CH_2 -, - $CH_2CH(CH_3)$ -, - $CH_2CH(CH_2OH)$ -, - $CH_2CH_2CH_2$ -, and mixtures thereof; each R^4 is selected from the group consisting of C₁-C₄ alkyl, C₁-C₄ hydroxyalkyl, benzyl ring structures formed by joining the two R^4 groups, - CH_2CHOH - $CHOHCOR^6CHOHCH_2OH$ wherein R^6 is any hexose or hexose polymer having a molecular weight less than about 1000, and hydrogen when y is not 0; R^5 is the same as R^4 or is an alkyl chain wherein the total number of carbon atoms of R^2 plus R^5 is not more than about 18; each y is from 0 to about 10 and the sum of the y values is from 0 to about 15; and X is any compatible anion.

Highly preferred cationic surfactants are the water-soluble quaternary ammonium compounds useful in the present composition having the formula (i): $R_1R_2R_3R_4N^+X^-$ wherein R_1 is C₈-C₁₆ alkyl, each of R_2 , R_3 and R_4 is independently C₁-C₄ alkyl, C₁-C₄ hydroxy alkyl, benzyl, and -(C₂H₄)_xH where x has a value from 2 to 5, and X is an anion. Not more than one of R_2 , R_3 or R_4 should be benzyl. The preferred alkyl chain length for R_1 is C₁₂-C₁₅ particularly where the alkyl group is a mixture of chain lengths derived from coconut or palm kernel fat or is derived synthetically by olefin build up or OXO alcohols synthesis. Preferred groups for R_2R_3 and R_4 are methyl and hydroxyethyl groups and the anion X may be selected from halide, methosulfate, acetate and phosphate ions.

Examples of suitable quaternary ammonium compounds of formulae (i) for use herein are include, but are not limited to: coconut trimethyl ammonium chloride or bromide; coconut methyl dihydroxyethyl ammonium chloride or bromide; decyl triethyl ammonium chloride; decyl dimethyl hydroxyethyl ammonium chloride or bromide; C₁₂-15 dimethyl hydroxyethyl ammonium chloride or bromide; coconut dimethyl hydroxyethyl ammonium chloride or bromide; myristyl trimethyl ammonium methyl sulphate; lauryl dimethyl benzyl ammonium chloride or bromide; lauryl dimethyl (ethenoxy)₄ ammonium chloride or bromide; choline esters (compounds of formula (i) wherein R_1 is CH₂-CH₂-O-C₁₂-14 alkyl and $R_2R_3R_4$ are methyl); and di-alkyl imidazolines [(ii)].



Other cationic surfactants useful herein are also described in U.S. Patent 4,228,044, Cambre, issued October 14, 1980 and in European Patent Application EP 000,224.

When included therein, the bleaching compositions of the present invention typically comprise from about 0.2%, preferably from about 1% to about 25%, preferably to about 8% by weight of such cationic surfactants.

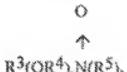
Ampholytic Surfactants - Ampholytic surfactants, examples of which are described in U.S. Patent No. 3,929,678, are also suitable for use in the bleaching compositions of the present invention.

When included therein, the bleaching compositions of the present invention typically comprise from about 0.2%, preferably from about 1% to about 15%, preferably to about 10% by weight of such ampholytic surfactants.

Zwitterionic Surfactants - Zwitterionic surfactants, examples of which are described in U.S. Patent No. 3,929,678, are also suitable for use in bleaching compositions.

When included therein, the bleaching compositions of the present invention typically comprise from about 0.2%, preferably from about 1% to about 15%, preferably to about 10% by weight of such zwitterionic surfactants.

Semi-polar Nonionic Surfactants - Semi-polar nonionic surfactants are a special category of nonionic surfactants which include water-soluble amine oxides having the formula:



wherein R³ is an alkyl, hydroxyalkyl, or alkyl phenyl group or mixtures thereof containing from about 8 to about 22 carbon atoms; R⁴ is an alkylene or hydroxyalkylene group containing from about 2 to about 3 carbon atoms or mixtures thereof; x is from 0 to about 3; and each R⁵ is an alkyl or hydroxyalkyl group containing from about 1 to about 3 carbon atoms or a polyethylene oxide group containing from about 1 to about 3 ethylene oxide groups (the R⁵ groups can be attached to each other, e.g., through an oxygen or nitrogen atom, to form a ring structure); water-soluble phosphine oxides containing one alkyl moiety of from about 10 to about 18 carbon atoms and 2 moieties selected from the group consisting of alkyl groups and hydroxyalkyl groups containing from about 1 to about 3 carbon atoms; and water-soluble sulfoxides containing one alkyl moiety of from about 10 to about 18 carbon atoms and a moiety selected from the group consisting of alkyl and hydroxyalkyl moieties of from about 1 to about 3 carbon atoms.

The amine oxide surfactants in particular include C₁₀-C₁₈ alkyl dimethyl amine oxides and C₈-C₁₂ alkoxy ethyl dihydroxy ethyl amine oxides.

When included therein, the cleaning compositions of the present invention typically comprise from about 0.2%, preferably from about 1% to about 15%, preferably to about 10% by weight of such semi-polar nonionic surfactants.

Cosurfactants - The bleaching compositions of the present invention may further comprise a cosurfactant selected from the group of primary or tertiary amines. Suitable primary amines for use herein include amines according to the formula R₁NH₂ wherein R₁

is a C₆-C₁₂, preferably C₆-C₁₀ alkyl chain or R₄X(CH₂)_n, X is -O-, -C(O)NH- or -NH-, R₄ is a C₆-C₁₂ alkyl chain n is between 1 to 5, preferably 3. R₁ alkyl chains may be straight or branched and may be interrupted with up to 12, preferably less than 5 ethylene oxide moieties.

Preferred amines according to the formula herein above are n-alkyl amines. Suitable amines for use herein may be selected from 1-hexylamine, 1-octylamine, 1-decylamine and laurylamine. Other preferred primary amines include C8-C10 oxypropylamine, octyloxypropylamine, 2-ethylhexyl-oxypropylamine, lauryl amido propylamine and amido propylamine. The most preferred amines for use in the compositions herein are 1-hexylamine, 1-octylamine, 1-decylamine, 1-dodecylamine. Especially desirable are n-dodecyldimethylamine and bishydroxyethylcoconutalkylamine and oleylamine 7 times ethoxylated, lauryl amido propylamine and cocoamido propylamine.

LFNIs - Particularly preferred surfactants in the automatic dishwashing compositions (ADD) of the present invention are low foaming nonionic surfactants (LFNI) which are described in U.S. Patent Nos. 5,705,464 and 5,710,115. LFNI may be present in amounts from 0.01% to about 10% by weight, preferably from about 0.1% to about 10%, and most preferably from about 0.25% to about 4%. LFNIs are most typically used in ADDs on account of the improved water-sheeting action (especially from glass) which they confer to the ADD product. They also encompass non-silicone, nonphosphate polymeric materials further illustrated hereinafter which are known to defoam food soils encountered in automatic dishwashing.

Preferred LFNIs include nonionic alkoxylated surfactants, especially ethoxylates derived from primary alcohols, and blends thereof with more sophisticated surfactants, such as the polyoxypropylene/polyoxyethylene/polyoxypropylene (PO/EO/PO) reverse block polymers as described in U.S. Patent Nos. 5,705,464 and 5,710,115.

LFNIs which may also be used include those POLY-TERGENT® SLF-18 nonionic surfactants from Olin Corp., and any biodegradable LFNI having the melting point properties discussed hereinabove.

These and other nonionic surfactants are well known in the art, being described in more detail in Kirk Othmer's Encyclopedia of Chemical Technology, 3rd Ed., Vol. 22, pp. 360-379, "Surfactants and Detergent Systems", incorporated by reference herein.

Bleaching Agents - The compositions of the present invention optionally comprise, in addition to the bleaching system described above, additional bleaching agents, such as chlorine bleaches (although less preferred for compositions which comprise enzymes) examples of which are known in the art, and include sodium dichloroisocyanurate ("NaDCC) and bleach catalysts. When present, these other bleaching agents will typically

be at levels of from about 1%, preferably from about 5% to about 30%, preferably to about 20% by weight of the composition.

(a) Organic Peroxides, especially Diacyl Peroxides - These are extensively illustrated in Kirk Othmer, Encyclopedia of Chemical Technology, Vol. 17, John Wiley and Sons, 1982 at pages 27-90 and especially at pages 63-72, all incorporated herein by reference. If a diacyl peroxide is used, it will preferably be one which exerts minimal adverse impact on spotting/filming.

(b) Metal-containing Bleach Catalysts - The present invention compositions and methods may utilize metal-containing bleach catalysts that are effective for use in bleaching compositions. Preferred are manganese and cobalt-containing bleach catalysts.

One type of metal-containing bleach catalyst is a catalyst system comprising a transition metal cation of defined bleach catalytic activity, such as copper, iron, titanium, ruthenium, tungsten, molybdenum, or manganese cations, an auxiliary metal cation having little or no bleach catalytic activity, such as zinc or aluminum cations, and a sequestrate having defined stability constants for the catalytic and auxiliary metal cations, particularly ethylenediaminetetraacetic acid, ethylenediaminetetra (methyleneephosphonic acid) and water-soluble salts thereof. Such catalysts are disclosed in U.S. 4,430,243 Bragg, issued February 2, 1982.

Manganese Metal Complexes - If desired, the compositions herein can be catalyzed by means of a manganese compound. Such compounds and levels of use are well known in the art and include, for example, the manganese-based catalysts disclosed in U.S. Patent Nos. 5,576,282; 5,246,621; 5,244,594; 5,194,416; and 5,114,606; and European Pat. App. Pub. Nos. 549,271 A1, 549,272 A1, 544,440 A2, and 544,490 A1; Preferred examples of these catalysts include $Mn^{IV}_2(u-O)_3(1,4,7-trimethyl-1,4,7-triazacyclononane)_2(PF_6)_2$, $Mn^{III}_2(u-O)_1(u-OAc)_2(1,4,7-trimethyl-1,4,7-triazacyclononane)_2(ClO_4)_2$, $Mn^{IV}_4(u-O)_6(1,4,7-triazacyclononane)_4(ClO_4)_4$, $Mn^{III}Mn^{IV}_4(u-O)_1(u-OAc)_2(1,4,7-trimethyl-1,4,7-triazacyclononane)_2(ClO_4)_3$, $Mn^{IV}(1,4,7-trimethyl-1,4,7-triazacyclononane)-(OCH_3)_3(PF_6)$, and mixtures thereof. Other metal-based bleach catalysts include those disclosed in U.S. Patent Nos. 4,430,243 and U.S. 5,114,611. The use of manganese with various complex ligands to enhance bleaching is also reported in the following: U.S. Patent Nos. 4,728,455; 5,284,944; 5,246,612; 5,256,779; 5,280,117; 5,274,147; 5,153,161; and 5,227,084.

Cobalt Metal Complexes - Cobalt bleach catalysts useful herein are known, and are described, for example, in U.S. Patent Nos. 5,597,936; 5,595,967; and 5,703,030; and M. L. Tobe, "Base Hydrolysis of Transition-Metal Complexes", *Adv. Inorg. Bioinorg. Mech.*, (1983), 2, pages 1-94. The most preferred cobalt catalyst useful herein are cobalt pentaamine acetate salts having the formula $[Co(NH_3)_5OAc]T_y$, wherein "OAc"

represents an acetate moiety and "T_y" is an anion, and especially cobalt pentaammine acetate chloride, [Co(NH₃)₅OAc]Cl₂; as well as [Co(NH₃)₅OAc](OAc)₂; [Co(NH₃)₅OAc](PF₆)₂; [Co(NH₃)₅OAc](SO₄); [Co(NH₃)₅OAc](BF₄)₂; and [Co(NH₃)₅OAc](NO₃)₂ (herein "PAC").

These cobalt catalysts are readily prepared by known procedures, such as taught for example in U.S. Patent Nos. 5,597,936; 5,595,967; and 5,703,030; in the Tobe article and the references cited therein; and in U.S. Patent 4,810,410; *J. Chem. Ed.* (1989), 66 (12), 1043-45; *The Synthesis and Characterization of Inorganic Compounds*, W.L. Jolly (Prentice-Hall; 1970), pp. 461-3; *Inorg. Chem.*, 18, 1497-1502 (1979); *Inorg. Chem.*, 21, 2881-2885 (1982); *Inorg. Chem.*, 18, 2023-2025 (1979); *Inorg. Synthesis*, 173-176 (1960); and *Journal of Physical Chemistry*, 56, 22-25 (1952).

Transition Metal Complexes of Macropoly cyclic Rigid Ligands - Compositions herein may also suitably include as bleach catalyst a transition metal complex of a macropoly cyclic rigid ligand. The phrase "macropoly cyclic rigid ligand" is sometimes abbreviated as "MRL" in discussion below. The amount used is a catalytically effective amount, suitably about 1 ppb or more, for example up to about 99.9%, more typically about 0.001 ppm or more, preferably from about 0.05 ppm to about 500 ppm (wherein "ppb" denotes parts per billion by weight and "ppm" denotes parts per million by weight).

Suitable transition metals e.g., Mn are illustrated hereinafter. "Macropoly cyclic" means a MRL is both a macrocycle and is polycyclic. "Polycyclic" means at least bicyclic. The term "rigid" as used herein herein includes "having a superstructure" and "cross-bridged". "Rigid" has been defined as the constrained converse of flexibility: see D.H. Busch., *Chemical Reviews*, (1993), 93, 847-860, incorporated by reference. More particularly, "rigid" as used herein means that the MRL must be determinably more rigid than a macrocycle ("parent macrocycle") which is otherwise identical (having the same ring size and type and number of atoms in the main ring) but lacking a superstructure (especially linking moieties or, preferably cross-bridging moieties) found in the MRL's. In determining the comparative rigidity of macrocycles with and without superstructures, the practitioner will use the free form (not the metal-bound form) of the macrocycles. Rigidity is well-known to be useful in comparing macrocycles; suitable tools for determining, measuring or comparing rigidity include computational methods (see, for example, Zimmer, *Chemical Reviews*, (1995), 95(38), 2629-2648 or Hancock et al., *Inorganica Chimica Acta*, (1989), 164, 73-84.

Preferred MRL's herein are a special type of ultra-rigid ligand which is cross-bridged. A "cross-bridge" is nonlimitingly illustrated in 1.11 hereinbelow. In 1.11, the cross-bridge is a -CH₂CH₂- moiety. It bridges N¹ and N⁸ in the illustrative structure. By comparison, a "same-side" bridge, for example if one were to be introduced across N¹ and

N^{12} in 1.11, would not be sufficient to constitute a "cross-bridge" and accordingly would not be preferred.

Suitable metals in the rigid ligand complexes include Mn(II), Mn(III), Mn(IV), Mn(V), Fe(II), Fe(III), Fe(IV), Co(I), Co(II), Co(III), Ni(I), Ni(II), Ni(III), Cu(I), Cu(II), Cu(III), Cr(II), Cr(III), Cr(IV), Cr(V), Cr(VI), V(III), V(IV), V(V), Mo(IV), Mo(V), Mo(VI), W(IV), W(V), W(VI), Pd(II), Ru(II), Ru(III), and Ru(IV). Preferred transition-metals in the instant transition-metal bleach catalyst include manganese, iron and chromium.

More generally, the MRL's (and the corresponding transition-metal catalysts) herein suitably comprise:

- (a) at least one macrocycle main ring comprising four or more heteroatoms; and
- (b) a covalently connected non-metal superstructure capable of increasing the rigidity of the macrocycle, preferably selected from
 - (i) a bridging superstructure, such as a linking moiety;
 - (ii) a cross-bridging superstructure, such as a cross-bridging linking moiety; and
 - (iii) combinations thereof.

The term "superstructure" is used herein as defined in the literature by Busch et al., see, for example, articles by Busch in "Chemical Reviews".

Preferred superstructures herein not only enhance the rigidity of the parent macrocycle, but also favor folding of the macrocycle so that it co-ordinates to a metal in a cleft. Suitable superstructures can be remarkably simple, for example a linking moiety such as any of those illustrated in Fig. 1 and Fig. 2 below, can be used.



Fig. 1

wherein n is an integer, for example from 2 to 8, preferably less than 6, typically 2 to 4, or

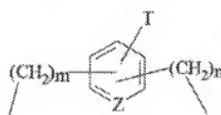


Fig. 2

wherein m and n are integers from about 1 to 8, more preferably from 1 to 3; Z is N or CH; and T is a compatible substituent, for example H, alkyl, trialkylammonium, halogen, nitro, sulfonate, or the like. The aromatic ring in 1.10 can be replaced by a saturated ring, in which the atom in Z connecting into the ring can contain N, O, S or C.

Suitable MRL's are further nonlimitingly illustrated by the following compound:

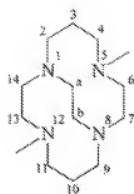


Fig. 3

This is a MRL in accordance with the invention which is a highly preferred, cross-bridged, methyl-substituted (all nitrogen atoms tertiary) derivative of cyclam. Formally, this ligand is named 5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane using the extended von Baeyer system. See "A Guide to IUPAC Nomenclature of Organic Compounds: Recommendations 1993", R. Panico, W.H. Powell and J-C Richer (Eds.), Blackwell Scientific Publications, Boston, 1993; see especially section R-2.4.2.1.

Transition-metal bleach catalysts of Macroyclic Rigid Ligands which are suitable for use in the invention compositions can in general include known compounds where they conform with the definition herein, as well as, more preferably, any of a large number of novel compounds expressly designed for the present laundry or cleaning uses, and non-limitingly illustrated by any of the following:

Dichloro-5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(II)

Diapro-5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(II)

Hexafluorophosphate

Aquo-hydroxy-5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(III)

Hexafluorophosphate

Diaquo-5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(II)

Tetrafluoroborate

Dichloro-5,12-dimethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(III)

Hexafluorophosphate

Dichloro-5,12-di-n-butyl-1,5,8,12-tetraaza bicyclo[6.6.2]hexadecane Manganese(II)

Dichloro-5,12-dibenzyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane Manganese(II)

Dichloro-5-n-butyl-12-methyl-1,5,8,12-tetraaza- bicyclo[6.6.2]hexadecane Manganese(II)

Dichloro-5-n-octyl-12-methyl-1,5,8,12-tetraaza- bicyclo[6.6.2]hexadecane Manganese(II)

Dichloro-5-n-butyl-12-methyl-1,5,8,12-tetraaza- bicyclo[6.6.2]hexadecane Manganese(II)

As a practical matter, and not by way of limitation, the compositions and cleaning processes herein can be adjusted to provide on the order of at least one part per hundred million of the active bleach catalyst species in the aqueous washing medium, and will preferably provide from about 0.01 ppm to about 25 ppm, more preferably from about 0.05

ppm to about 10 ppm, and most preferably from about 0.1 ppm to about 5 ppm, of the bleach catalyst species in the wash liquor. In order to obtain such levels in the wash liquor of an automatic washing process, typical compositions herein will comprise from about 0.0005% to about 0.2%, more preferably from about 0.004% to about 0.08%, of bleach catalyst, especially manganese or cobalt catalysts, by weight of the bleaching compositions.

(d) Other Bleach Catalysts - The compositions herein may comprise one or more other bleach catalysts. Preferred bleach catalysts are zwitterionic bleach catalysts, which are described in U.S. Patent No. 5,576,282 (especially 3-(3,4-dihydroisoquinolinium) propane sulfonate. Other bleach catalysts include cationic bleach catalysts are described in U.S. Patent Nos. 5,360,569, 5,442,066, 5,478,357, 5,370,826, 5,482,515, 5,550,256, and WO 95/13351, WO 95/13352, and WO 95/13353.

Optional Detergent Enzymes - The detergent and bleaching compositions herein may also optionally contain one or more types of detergent enzymes. Such enzymes can include other proteases, amylases, cellulases and lipases. Such materials are known in the art and are commercially available under such trademarks as . They may be incorporated into the non-aqueous liquid detergent compositions herein in the form of suspensions, "marumes" or "prills". Another suitable type of enzyme comprises those in the form of slurries of enzymes in nonionic surfactants, e.g., the enzymes marketed by Novo Nordisk under the tradename "SL" or the microencapsulated enzymes marketed by Novo Nordisk under the tradename "LDP." Suitable enzymes and levels of use are described in U.S. Pat. No. 5,576,282, 5,705,464 and 5,710,115.

Enzymes added to the compositions herein in the form of conventional enzyme prills are especially preferred for use herein. Such prills will generally range in size from about 100 to 1,000 microns, more preferably from about 200 to 800 microns and will be suspended throughout the non-aqueous liquid phase of the composition. Prills in the compositions of the present invention have been found, in comparison with other enzyme forms, to exhibit especially desirable enzyme stability in terms of retention of enzymatic activity over time. Thus, compositions which utilize enzyme prills need not contain conventional enzyme stabilizing such as must frequently be used when enzymes are incorporated into aqueous liquid detergents.

However, enzymes added to the compositions herein may be in the form of granulates, preferably T-granulates.

"Detergent enzyme", as used herein, means any enzyme having a cleaning, stain removing or otherwise beneficial effect in a laundry, hard surface cleaning or personal care detergent composition. Preferred detergents enzymes are hydrolases such as proteases, amylases and lipases. Preferred enzymes for laundry purposes include, but are not limited to, proteases, cellulases, lipases and peroxidases. Highly preferred for automatic

dishwashing are amylases and/or proteases, including both current commercially available types and improved types which, though more and more bleach compatible through successive improvements, have a remaining degree of bleach deactivation susceptibility.

Examples of suitable enzymes include, but are not limited to, hemicellulases, peroxidases, proteases, cellulases, xylanases, lipases, phospholipases, esterases, cutinases, pectinases, keratanases, reductases, oxidases, phenoloxidases, lipoxygenases, ligninases, pullulanases, tannases, pentosanases, malanases, β -glucanases, arabinosidases, hyaluronidase, chondroitinase, laccase, and known amylases, or mixtures thereof.

Examples of such suitable enzymes are disclosed in U.S. Patent Nos. 5,705,464, 5,710,115, 5,576,282, 5,728,671 and 5,707,950.

The cellulases useful in the present invention include both bacterial or fungal cellulases. Preferably, they will have a pH optimum of between 5 and 12 and a specific activity above 50 CEVU/mg (Cellulose Viscosity Unit). Suitable cellulases are disclosed in U.S. Patent 4,435,307, J61078384 and WO96/02653 which discloses fungal cellulase produced respectively from *Humicola insolens*, *Trichoderma*, *Thielavia* and *Sporotrichum*. EP 739 982 describes cellulases isolated from novel *Bacillus* species. Suitable cellulases are also disclosed in GB-A-2.075.028; GB-A-2.095.275; DE-OS-2.247.832 and WO95/26398.

Examples of such cellulases are cellulases produced by a strain of *Humicola insolens* (*Humicola grisea* var. *thermoidea*), particularly the *Humicola* strain DSM 1800. Other suitable cellulases are cellulases originated from *Humicola insolens* having a molecular weight of about 50kDa, an isoelectric point of 5.5 and containing 415 amino acids; and a ~43kD endoglucanase derived from *Humicola insolens*, DSM 1800, exhibiting cellulase activity; a preferred endoglucanase component has the amino acid sequence disclosed in WO 91/17243. Also suitable cellulases are the EGIII cellulases from *Trichoderma longibrachiatum* described in WO94/21801 to Genencor. Especially suitable cellulases are the cellulases having color care benefits. Examples of such cellulases are cellulases described in European patent application No. 91202879.2, filed November 6, 1991 (Novo). Carezyme and Celluzyme (Novo Nordisk A/S) are especially useful. See also WO91/17244 and WO91/21801. Other suitable cellulases for fabric care and/or cleaning properties are described in WO96/34092, WO96/17994 and WO95/24471.

Cellulases, when present, are normally incorporated in the cleaning composition at levels from 0.001% to 2% of pure enzyme by weight of the cleaning composition.

Peroxidase enzymes are used in combination with oxygen sources, e.g. percarbonate, perborate, persulfate, hydrogen peroxide, etc and with a phenolic substrate as bleach enhancing molecule. They are used for "solution bleaching", i.e. to prevent transfer of dyes or pigments removed from substrates during wash operations to other substrates in

the wash solution. Peroxidase enzymes are known in the art, and include, for example, horseradish peroxidase, ligninase and haloperoxidase such as chloro- and bromoperoxidase. Suitable peroxidases and peroxidase-containing detergent compositions are disclosed, for example, in U.S. Patent Nos. 5,705,464, 5,710,115, 5,576,282, 5,728,671 and 5,707,950, PCT International Application WO 89/099813, WO89/09813 and in European Patent application EP No. 91202882.6, filed on November 6, 1991 and EP No. 96870013.8, filed February 20, 1996. Also suitable is the laccase enzyme.

Enhancers are generally comprised at a level of from 0.1% to 5% by weight of total composition. Preferred enhancers are substituted phenothiazine and phenoxazine 10-Phenothiazinepropionic acid (PPT), 10-ethylphenothiazine-4-carboxylic acid (EPC), 10-phenoxazinepropionic acid (POP) and 10-methylphenoxazine (described in WO 94/12621) and substituted syringates (C3-C5 substituted alkyl syringates) and phenols. Sodium percarbonate or perborate are preferred sources of hydrogen peroxide.

Said peroxidases are normally incorporated in the cleaning composition at levels from 0.0001% to 2% of pure enzyme by weight of the cleaning composition.

Enzymatic systems may be used as bleaching agents. The hydrogen peroxide may also be present by adding an enzymatic system (i.e. an enzyme and a substrate therefore) which is capable of generating hydrogen peroxide at the beginning or during the washing and/or rinsing process. Such enzymatic systems are disclosed in EP Patent Application 91202655.6 filed October 9, 1991.

Other preferred enzymes that can be included in the cleaning compositions of the present invention include lipases. Suitable lipase enzymes for detergent usage include those produced by microorganisms of the *Pseudomonas* group, such as *Pseudomonas stutzeri* ATCC 19.154, as disclosed in British Patent 1,372,034. Suitable lipases include those which show a positive immunological cross-reaction with the antibody of the lipase, produced by the microorganism *Pseudomonas fluorescent* IAM 1057. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," hereinafter referred to as "Amano-P". Other suitable commercial lipases include Amano-CRS, lipases ex *Chromobacter viscosum*, e.g. *Chromobacter viscosum* var. *lipolyticum* NRRLB 3673 from Toyo Jozo Co., Tagata, Japan; *Chromobacter viscosum* lipases from U.S. Biochemical Corp., U.S.A. and Disoynt Co., The Netherlands, and lipases ex *Pseudomonas gladioli*. Especially suitable lipases are lipases such as M1 Lipase^R and Lipomax^R (Gist-Brocades) and Lipolase^R and Lipolase Ultra^R(Novo) which have found to be very effective when used in combination with the compositions of the present invention. Also suitable are the lipolytic enzymes described in EP 258 068, WO 92/05249 and WO 95/22615 by Novo Nordisk and in WO 94/03578, WO 95/35381 and WO 96/00292 by Unilever.

Also suitable are cutinases [EC 3.1.1.50] which can be considered as a special kind of lipase, namely lipases which do not require interfacial activation. Addition of cutinases to cleaning compositions have been described in e.g. WO-A-88/09367 (Genencor); WO 90/09446 (Plant Genetic System) and WO 94/14963 and WO 94/14964 (Unilever).

Lipases and/or cutinases, when present, are normally incorporated in the cleaning composition at levels from 0.0001% to 2% of pure enzyme by weight of the cleaning composition.

In addition to the above referenced lipases, phospholipases may be incorporated into the cleaning compositions of the present invention. Nonlimiting examples of suitable phospholipases include: EC 3.1.1.32 Phospholipase A1; EC 3.1.1.4 Phospholipase A2; EC 3.1.1.5 Lysopholipase; EC 3.1.4.3 Phospholipase C; EC 3.1.4.4. Phospholipase D. Commercially available phospholipases include LECITASE® from Novo Nordisk A/S of Denmark and Phospholipase A2 from Sigma. When phospholipases are included in the compositions of the present invention, it is preferred that amylases are also included. Without desiring to be bound by theory, it is believed that the combined action of the phospholipase and amylase provide substantive stain removal, especially on greasy/oily, starch and highly colored stains and soils. Preferably, the phospholipase and amylase, when present, are incorporated into the compositions of the present invention at a pure enzyme weight ratio between 4500:1 and 1:5, more preferably between 50:1 and 1:1.

Suitable proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis* (subtilisin BPN and BPN'). One suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold as ESPERASE® by Novo Industries A/S of Denmark, hereinafter "Novo". The preparation of this enzyme and analogous enzymes is described in GB 1,243,784 to Novo. Proteolytic enzymes also encompass modified bacterial serine proteases, such as those described in European Patent Application Serial Number 87 303761.8, filed April 28, 1987 (particularly pages 17, 24 and 98), and which is called herein "Protease B", and in European Patent Application 199,404, Venegas, published October 29, 1986, which refers to a modified bacterial serine proteolytic enzyme which is called "Protease A" herein. Suitable is the protease called herein "Protease C", which is a variant of an alkaline serine protease from *Bacillus* in which Lysine replaced arginine at position 27, tyrosine replaced valine at position 104, serine replaced asparagine at position 123, and alanine replaced threonine at position 274. Protease C is described in EP 90915958.4, corresponding to WO 91/06637, Published May 16, 1991. Genetically modified variants, particularly of Protease C, are also included herein.

A preferred protease referred to as "Protease D" is a carbonyl hydrolase as described in U.S. Patent No. 5,677,272, and WO95/10591. Also suitable is a carbonyl

hydrolase variant of the protease described in WO95/10591, having an amino acid sequence derived by replacement of a plurality of amino acid residues replaced in the precursor enzyme corresponding to position +210 in combination with one or more of the following residues : +33, +62, +67, +76, +100, +101, +103, +104, +107, +128, +129, +130, +132, +135, +136, +158, +164, +166, +167, +170, +209, +215, +217, +218, and +222, where the numbered position corresponds to naturally-occurring subtilisin from *Bacillus amyloliquefaciens* or to equivalent amino acid residues in other carbonyl hydrolases or subtilisins, such as *Bacillus lenthus* subtilisin (co-pending patent application US Serial No. 60/048,550, filed June 04, 1997 and PCT International Application Serial No. PCT/IB98/00853).

Also suitable for the present invention are proteases described in patent applications EP 251 446 and WO 91/06637, protease BLAP® described in WO91/02792 and their variants described in WO 95/23221.

See also a high pH protease from *Bacillus* sp. NCIMB 40338 described in WO 93/18140 A to Novo. Enzymatic detergents comprising protease, one or more other enzymes, and a reversible protease inhibitor are described in WO 92/03529 A to Novo. When desired, a protease having decreased adsorption and increased hydrolysis is available as described in WO 95/07791 to Procter & Gamble. A recombinant trypsin-like protease for detergents suitable herein is described in WO 94/25583 to Novo. Other suitable proteases are described in EP 516 200 by Unilever.

Particularly useful proteases are described in PCT publications: WO 95/30010; WO 95/30011; and WO 95/29979. Suitable proteases are commercially available as ESPERASE®, ALCALASE®, DURAZYM®, SAVINASE®, EVERLASE® and KANNASE® all from Novo Nordisk A/S of Denmark, and as MAXATASE®, MAXACAL®, PROPERASE® and MAXAPEM® all from Genencor International (formerly Gist-Brocades of The Netherlands).

Such proteolytic enzymes, when present, are incorporated in the cleaning compositions of the present invention a level of from 0.0001% to 2%, preferably from 0.001% to 0.2%, more preferably from 0.005% to 0.1% pure enzyme by weight of the composition.

Amylases (α and/or β) can be included for removal of carbohydrate-based stains. WO94/02597 describes cleaning compositions which incorporate mutant amylases. See also WO95/10603. Other amylases known for use in cleaning compositions include both α - and β -amylases. α -Amylases are known in the art and include those disclosed in US Pat. no. 5,003,257; EP 252,666; WO/91/00353; FR 2,676,456; EP 285,123; EP 525,610; EP 368,341; and British Patent specification no. 1,296,839 (Novo). Other suitable amylases are stability-enhanced amylases described in WO94/18314 and WO96/05295, Genencor, and

amylase variants having additional modification in the immediate parent available from Novo Nordisk A/S, disclosed in WO 95/10603. Also suitable are amylases described in EP 277 216.

Examples of commercial α -amylases products are Purafect Ox Am[®] from Genencor and Termamyl[®], Ban[®], Fungamyl[®] and Duramyl[®], all available from Novo Nordisk A/S Denmark. WO95/26397 describes other suitable amylases : α -amylases characterised by having a specific activity at least 25% higher than the specific activity of Termamyl[®] at a temperature range of 25°C to 55°C and at a pH value in the range of 8 to 10, measured by the Phadebas[®] α -amylase activity assay. Suitable are variants of the above enzymes, described in WO96/23873 (Novo Nordisk). Other amyloytic enzymes with improved properties with respect to the activity level and the combination of thermostability and a higher activity level are described in WO95/35382.

Such amyloytic enzymes, when present, are incorporated in the clearing compositions of the present invention a level of from 0.0001% to 2%, preferably from 0.00018% to 0.06%, more preferably from 0.00024% to 0.048% pure enzyme by weight of the composition.

The above-mentioned enzymes may be of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. Origin can further be mesophilic or extremophilic (psychrophilic, psychrotrophic, thermophilic, barophilic, alkalophilic, acidophilic, halophilic, etc.). Purified or non-purified forms of these enzymes may be used. Nowadays, it is common practice to modify wild-type enzymes via protein / genetic engineering techniques in order to optimize their performance efficiency in the laundry detergent and/or fabric care compositions of the invention. For example, the variants may be designed such that the compatibility of the enzyme to commonly encountered ingredients of such compositions is increased. Alternatively, the variant may be designed such that the optimal pH, bleach or chelant stability, catalytic activity and the like, of the enzyme variant is tailored to suit the particular cleaning application.

In particular, attention should be focused on amino acids sensitive to oxidation in the case of bleach stability and on surface charges for the surfactant compatibility. The isoelectric point of such enzymes may be modified by the substitution of some charged amino acids, e.g. an increase in isoelectric point may help to improve compatibility with anionic surfactants. The stability of the enzymes may be further enhanced by the creation of e.g. additional salt bridges and enforcing calcium binding sites to increase chelant stability.

These optional detergents enzymes, when present, are normally incorporated in the cleaning composition at levels from 0.0001% to 2% of pure enzyme by weight of the cleaning composition. The enzymes can be added as separate single ingredients (prills,

granulates, stabilized liquids, etc... containing one enzyme) or as mixtures of two or more enzymes (e.g. cogranulates).

Other suitable detergent ingredients that can be added are enzyme oxidation scavengers. Examples of such enzyme oxidation scavengers are ethoxylated tetraethylene polyamines.

A range of enzyme materials and means for their incorporation into synthetic detergent compositions is also disclosed in WO 9307263 and WO 9307260 to Genencor International, WO 8908694, and U.S. 3,553,139, January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. 4,101,457, and in U.S. 4,507,219. Enzyme materials useful for liquid detergent formulations, and their incorporation into such formulations, are disclosed in U.S. 4,261,868.

Enzyme Stabilizers - Enzymes for use in detergents can be stabilized by various techniques. Enzyme stabilization techniques are disclosed and exemplified in U.S. 3,600,319, EP 199,405 and EP 200,586. Enzyme stabilization systems are also described, for example, in U.S. 3,519,570. A useful *Bacillus*, sp. AC13 giving proteases, xylanases and cellulases, is described in WO 9401532. The enzymes employed herein can be stabilized by the presence of water-soluble sources of calcium and/or magnesium ions in the finished compositions which provide such ions to the enzymes. Suitable enzyme stabilizers and levels of use are described in U.S. Pat. Nos. 5,705,464, 5,710,115 and 5,576,282.

Builders - The detergent and bleaching compositions described herein preferably comprise one or more detergent builders or builder systems. When present, the compositions will typically comprise at least about 1% builder, preferably from about 5%, more preferably from about 10% to about 80%, preferably to about 50%, more preferably to about 30% by weight, of detergent builder. Lower or higher levels of builder, however, are not meant to be excluded.

Preferred builders for use in the detergent and bleaching compositions, particularly dishwashing compositions, described herein include, but are not limited to, water-soluble builder compounds, (for example polycarboxylates) as described in U.S. Patent Nos. 5,695,679, 5,705,464 and 5,710,115. Other suitable polycarboxylates are disclosed in U.S. Patent Nos. 4,144,226, 3,308,067 and 3,723,322. Preferred polycarboxylates are hydroxycarboxylates containing up to three carboxy groups per molecule, more particularly titrates.

Inorganic or P-containing detergent builders include, but are not limited to, the alkali metal, ammonium and alkanolammonium salts of polyphosphates (exemplified by the tripolyphosphates, pyrophosphates, and glassy polymeric meta-phosphates), phosphonates (see, for example, U.S. Patent Nos. 3,159,581; 3,213,030; 3,422,021;

3,400,148 and 3,422,137), phytic acid, silicates, carbonates (including bicarbonates and sesquicarbonates), sulphates, and aluminosilicates.

However, non-phosphate builders are required in some locales. Importantly, the compositions herein function surprisingly well even in the presence of the so-called "weak" builders (as compared with phosphates) such as citrate, or in the so-called "underbuilt" situation that may occur with zeolite or layered silicate builders.

Suitable silicates include the water-soluble sodium silicates with an SiO₃:Na₂O ratio of from about 1.0 to 2.8, with ratios of from about 1.6 to 2.4 being preferred, and about 2.0 ratio being most preferred. The silicates may be in the form of either the anhydrous salt or a hydrated salt. Sodium silicate with an SiO₃:Na₂O ratio of 2.0 is the most preferred. Silicates, when present, are preferably present in the detergent and bleaching compositions described herein at a level of from about 5% to about 50% by weight of the composition, more preferably from about 10% to about 40% by weight.

Partially soluble or insoluble builder compounds, which are suitable for use in the detergent and bleaching compositions, particularly granular detergent compositions, include, but are not limited to, crystalline layered silicates, preferably crystalline layered sodium silicates (partially water-soluble) as described in U.S. Patent No. 4,664,839, and sodium aluminosilicates (water-insoluble). When present in detergent and bleaching compositions, these builders are typically present at a level of from about 1% to 80% by weight, preferably from about 10% to 70% by weight, most preferably from about 20% to 60% by weight of the composition.

Crystalline layered sodium silicates having the general formula NaMSi_xO_{2x+1}·yH₂O wherein M is sodium or hydrogen, x is a number from about 1.9 to about 4, preferably from about 2 to about 4, most preferably 2, and y is a number from about 0 to about 20, preferably 0 can be used in the compositions described herein.

Crystalline layered sodium silicates of this type are disclosed in EP-A-0164514 and methods for their preparation are disclosed in DE-A-3417649 and DE-A-3742043. The most preferred material is delta-Na₂SiO₅, available from Hoechst AG as NaSKS-6 (commonly abbreviated herein as "SKS-6"). Unlike zeolite builders, the Na SKS-6 silicate builder does not contain aluminum. NaSKS-6 has the delta-Na₂SiO₅ morphology form of layered silicate. SKS-6 is a highly preferred layered silicate for use in the compositions described herein herein, but other such layered silicates, such as those having the general formula NaMSi_xO_{2x+1}·yH₂O wherein M is sodium or hydrogen, x is a number from 1.9 to 4, preferably 2, and y is a number from 0 to 20, preferably 0 can be used in the compositions described herein. Various other layered silicates from Hoechst include NaSKS-5, NaSKS-7 and NaSKS-11, as the alpha, beta and gamma forms. As noted above, the delta-Na₂SiO₅ (NaSKS-6 form) is most preferred for use herein. Other silicates may

also be useful such as for example magnesium silicate, which can serve as a crispening agent in granular formulations, as a stabilizing agent for oxygen bleaches, and as a component of soda control systems.

The crystalline layered sodium silicate material is preferably present in granular detergent compositions as a particulate in intimate admixture with a solid, water-soluble ionizable material. The solid, water-soluble ionizable material is preferably selected from organic acids, organic and inorganic acid salts and mixtures thereof.

Aluminosilicate builders are of great importance in most currently marketed heavy duty granular detergent compositions, and can also be a significant builder ingredient in liquid detergent formulations. Aluminosilicate builders have the empirical formula:

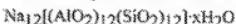


wherein z and y are integers of at least 6, the molar ratio of z to y is in the range from 1.0 to about 0.5, and x is an integer from about 15 to about 264. Preferably, the aluminosilicate builder is an aluminosilicate zeolite having the unit cell formula:



wherein z and y are at least 6; the molar ratio of z to y is from 1.0 to 0.5 and x is at least 5, preferably 7.5 to 276, more preferably from 10 to 264. The aluminosilicate builders are preferably in hydrated form and are preferably crystalline, containing from about 10% to about 28%, more preferably from about 18% to about 22% water in bound form.

These aluminosilicate ion exchange materials can be crystalline or amorphous in structure and can be naturally-occurring aluminosilicates or synthetically derived. A method for producing aluminosilicate ion exchange materials is disclosed in U.S. 3,985,669. Preferred synthetic crystalline aluminosilicate ion exchange materials useful herein are available under the designations Zeolite A, Zeolite B, Zeolite P, Zeolite X, Zeolite MAP and Zeolite HS and mixtures thereof. In an especially preferred embodiment, the crystalline aluminosilicate ion exchange material has the formula:



wherein x is from about 20 to about 30, especially about 27. This material is known as Zeolite A. Dehydrated zeolites (x = 0 - 10) may also be used herein. Preferably, the aluminosilicate has a particle size of about 0.1-10 microns in diameter. Zeolite X has the formula:



Citrate builders, e.g., citric acid and soluble salts thereof (particularly sodium salt), are polycarboxylate builders of particular importance for heavy duty liquid detergent formulations due to their availability from renewable resources and their biodegradability. Citrates can also be used in granular compositions, especially in combination with zeolite

and/or layered silicate builders. Oxydisuccinates are also especially useful in such compositions and combinations.

Also suitable in the detergent compositions described herein are the 3,3-dicarboxy-4-oxa-1,6-hexanedioates and the related compounds disclosed in U.S. 4,566,984. Useful succinic acid builders include the C₅-C₂₀ alkyl and alkenyl succinic acids and salts thereof. A particularly preferred compound of this type is dodecenylysuccinic acid. Specific examples of succinate builders include: laurylsuccinate, myristylsuccinate, palmitylsuccinate, 2-dodecenylysuccinate (preferred), 2-pentadecenylsuccinate, and the like. Laurylsuccinates are the preferred builders of this group, and are described in European Patent Application 86200690.5/0,200,263, published November 5, 1986.

Fatty acids, e.g., C₁₂-C₁₈ monocarboxylic acids, can also be incorporated into the compositions alone, or in combination with the aforesaid builders, especially citrate and/or the succinate builders, to provide additional builder activity. Such use of fatty acids will generally result in a diminution of sudsing, which should be taken into account by the formulator.

Dispersants - One or more suitable polyalkyleneimine dispersants may be incorporated into the cleaning compositions of the present invention. Examples of such suitable dispersants can be found in European Patent Application Nos. 111,965, 111,984, and 112,592; U.S. Patent Nos. 4,597,898, 4,548,744, and 5,565,145. However, any suitable clay/soil dispergent or anti-redeposition agent can be used in the laundry compositions of the present invention.

In addition, polymeric dispersing agents which include polymeric polycarboxylates and polyethylene glycols, are suitable for use in the present invention. Unsaturated monomeric acids that can be polymerized to form suitable polymeric polycarboxylates include acrylic acid, maleic acid (or maleic anhydride), fumaric acid, itaconic acid, acconitic acid, mesaconic acid, citraconic acid and methylenemalonic acid. Particularly suitable polymeric polycarboxylates can be derived from acrylic acid. Such acrylic acid-based polymers which are useful herein are the water-soluble salts of polymerized acrylic acid. The average molecular weight of such polymers in the acid form preferably ranges from about 2,000 to 10,000, more preferably from about 4,000 to 7,000 and most preferably from about 4,000 to 5,000. Water-soluble salts of such acrylic acid polymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble polymers of this type are known materials. Use of polyacrylates of this type in detergent compositions has been disclosed, for example, in U.S. 3,308,067.

Acrylic/maleic-based copolymers may also be used as a preferred component of the dispersing/anti-redeposition agent. Such materials include the water-soluble salts of copolymers of acrylic acid and maleic acid. The average molecular weight of such

copolymers in the acid form preferably ranges from about 2,000 to 100,000, more preferably from about 5,000 to 75,000, most preferably from about 7,000 to 65,000. The ratio of acrylate to maleate segments in such copolymers will generally range from about 30:1 to about 1:1, more preferably from about 10:1 to 2:1. Water-soluble salts of such acrylic acid/maleic acid copolymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble acrylate/maleate copolymers of this type are known materials which are described in European Patent Application No. 66915, published December 15, 1982, as well as in EP 193,360, published September 3, 1986, which also describes such polymers comprising hydroxypropylacrylate. Still other useful dispersing agents include the maleic/acrylic/vinyl alcohol terpolymers. Such materials are also disclosed in EP 193,360, including, for example, the 45/45/10 terpolymer of acrylic/maleic/vinyl alcohol.

Another polymeric material which can be included is polyethylene glycol (PEG). PEG can exhibit dispersing agent performance as well as act as a clay soil removal-antiredeposition agent. Typical molecular weight ranges for these purposes range from about 500 to about 100,000, preferably from about 1,000 to about 50,000, more preferably from about 1,500 to about 10,000.

Polyaspartate and polyglutamate dispersing agents may also be used, especially in conjunction with zeolite builders. Dispersing agents such as polyaspartate preferably have a molecular weight (avg.) of about 10,000.

Soil Release Agents - The compositions according to the present invention may optionally comprise one or more soil release agents. If utilized, soil release agents will generally comprise from about 0.01%, preferably from about 0.1%, more preferably from about 0.2% to about 10%, preferably to about 5%, more preferably to about 3% by weight, of the composition. Nonlimiting examples of suitable soil release polymers are disclosed in: U.S. Patent Nos. 5,728,671; 5,691,298; 5,599,782; 5,415,807; 5,182,043; 4,956,447; 4,976,879; 4,968,451; 4,925,577; 4,861,512; 4,877,896; 4,771,730; 4,711,730; 4,721,580; 4,000,093; 3,959,230; and 3,893,929; and European Patent Application 0 219 048.

Further suitable soil release agents are described in U.S. Patent Nos. 4,201,824; 4,240,918; 4,525,524; 4,579,681; 4,220,918; and 4,787,989; EP 279,134 A; EP 457,205 A; and DE 2,335,044.

Chelating Agents - The compositions of the present invention herein may also optionally contain a chelating agent which serves to chelate metal ions and metal impurities which would otherwise tend to deactivate the bleaching agent(s). Useful chelating agents can include amino carboxylates, phosphonates, amino phosphonates, polyfunctionally-substituted aromatic chelating agents and mixtures thereof. Further examples of suitable

chelating agents and levels of use are described in U.S. Pat. Nos. 5,705,464, 5,710,115, 5,728,671 and 5,576,282.

The compositions herein may also contain water-soluble methyl glycine diacetic acid (MGDA) salts (or acid form) as a chelant or co-builder useful with, for example, insoluble builders such as zeolites, layered silicates and the like.

If utilized, these chelating agents will generally comprise from about 0.1% to about 15%, more preferably from about 0.1% to about 3.0% by weight of the detergent compositions herein.

Suds suppressor - Another optional ingredient is a suds suppressor, exemplified by silicones, and silica-silicone mixtures. Examples of suitable suds suppressors are disclosed in U.S. Patent Nos. 5,707,950 and 5,728,671. These suds suppressors are normally employed at levels of from 0.001% to 2% by weight of the composition, preferably from 0.01% to 1% by weight.

Softening agents - Fabric softening agents can also be incorporated into laundry detergent compositions in accordance with the present invention. Inorganic softening agents are exemplified by the smectite clays disclosed in GB-A-1 400 898 and in U.S. 5,019,292.

Organic softening agents include the water insoluble tertiary amines as disclosed in GB-A-1 514 276 and EP-B-011 340 and their combination with mono C12-C14 quaternary ammonium salts are disclosed in EP-B-026 527 and EP-B-026 528 and di-long-chain amides as disclosed in EP-B-0 242 919. Other useful organic ingredients of fabric softening systems include high molecular weight polyethylene oxide materials as disclosed in EP-A-0 299 575 and 0 313 146.

Particularly suitable fabric softening agents are disclosed in U.S. Patent Nos. 5,707,950 and 5,728,673.

Levels of smectite clay are normally in the range from 2% to 20%, more preferably from 5% to 15% by weight, with the material being added as a dry mixed component to the remainder of the formulation. Organic fabric softening agents such as the water-insoluble tertiary amines or dilong chain amide materials are incorporated at levels of from 0.5% to 5% by weight, normally from 1% to 3% by weight whilst the high molecular weight polyethylene oxide materials and the water soluble cationic materials are added at levels of from 0.1% to 2%, normally from 0.15% to 1.5% by weight. These materials are normally added to the spray dried portion of the composition, although in some instances it may be more convenient to add them as a dry mixed particulate, or spray them as molten liquid on to other solid components of the composition.

Biodegradable quaternary ammonium compounds as described in EP-A-040 562 and EP-A-239 910 have been presented as alternatives to the traditionally used di-long alkyl chain ammonium chlorides and methyl sulfates.

Non-limiting examples of softener-compatible anions for the quaternary ammonium compounds and amine precursors include chloride or methyl sulfate.

Dye transfer inhibition - The detergent compositions of the present invention can also include compounds for inhibiting dye transfer from one fabric to another of solubilized and suspended dyes encountered during fabric laundering and conditioning operations involving colored fabrics.

Polymeric dye transfer inhibiting agents

The detergent compositions according to the present invention can also comprise from 0.001% to 10 %, preferably from 0.01% to 2%, more preferably from 0.05% to 1% by weight of polymeric dye transfer inhibiting agents. Said polymeric dye transfer inhibiting agents are normally incorporated into detergent compositions in order to inhibit the transfer of dyes from colored fabrics onto fabrics washed therewith. These polymers have the ability to complex or adsorb the fugitive dyes washed out of dyed fabrics before the dyes have the opportunity to become attached to other articles in the wash.

Especially suitable polymeric dye transfer inhibiting agents are polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinylpyrrolidone polymers, polyvinyloxazolidones and polyvinylimidazoles or mixtures thereof. Examples of such dye transfer inhibiting agents are disclosed in U.S. Patent Nos. 5,707,950 and 5,707,951.

Additional suitable dye transfer inhibiting agents include, but are not limited to, cross-linked polymers. Cross-linked polymers are polymers whose backbone are interconnected to a certain degree; these links can be of chemical or physical nature, possibly with active groups in the backbone or on branches; cross-linked polymers have been described in the Journal of Polymer Science, volume 22, pages 1035-1039.

In one embodiment, the cross-linked polymers are made in such a way that they form a three-dimensional rigid structure, which can entrap dyes in the pores formed by the three-dimensional structure. In another embodiment, the cross-linked polymers entrap the dyes by swelling. Such cross-linked polymers are described in the co-pending European patent application 94870213.9.

Addition of such polymers also enhances the performance of the enzymes according the invention.

pH and Buffering Variation - Many of the detergent and bleaching compositions described herein will be buffered, i.e., they are relatively resistant to pH drop in the presence of acidic soils. However, other compositions herein may have exceptionally low buffering capacity, or may be substantially unbuffered. Techniques for controlling or varying pH at recommended usage levels more generally include the use of not only

buffers, but also additional alkalis, acids, pH-jump systems, dual compartment containers, etc., and are well known to those skilled in the art.

The preferred ADD compositions herein comprise a pH-adjusting component selected from water-soluble alkaline inorganic salts and water-soluble organic or inorganic builders as described in U.S. Patent Nos. 5,705,464 and 5,710,115.

Material Care Agents - The preferred ADD compositions may contain one or more material care agents which are effective as corrosion inhibitors and/or anti-tarnish aids as described in U.S. Patent Nos. 5,705,464, 5,710,115 and 5,646,101.

When present, such protecting materials are preferably incorporated at low levels, e.g., from about 0.01% to about 5% of the ADD composition.

Other Materials - Detergent ingredients or adjuncts optionally included in the instant compositions can include one or more materials for assisting or enhancing cleaning performance, treatment of the substrate to be cleaned, or designed to improve the aesthetics of the compositions. Adjuncts which can also be included in compositions of the present invention, at their conventional art-established levels for use (generally, adjunct materials comprise, in total, from about 30% to about 99.9%, preferably from about 70% to about 95%, by weight of the compositions), include other active ingredients such as non-phosphate builders, color speckles, silvencare, anti-tarnish and/or anti-corrosion agents, dyes, fillers, germicides, alkalinity sources, hydrotropes, anti-oxidants, perfumes, solubilizing agents, carriers, processing aids, pigments, and pH control agents as described in U.S. Patent Nos. 5,705,464, 5,710,115, 5,698,504, 5,695,679, 5,686,014 and 5,646,101.

Methods of Cleaning - In addition to the methods for cleaning fabrics, dishes and other hard surfaces, and body parts by personal cleansing, described herein, the invention herein also encompasses a laundering pretreatment process for fabrics which have been soiled or stained comprising directly contacting said stains and/or soils with a highly concentrated form of the bleaching composition set forth above prior to washing such fabrics using conventional aqueous washing solutions. Preferably, the bleaching composition remains in contact with the soil/stain for a period of from about 30 seconds to 24 hours prior to washing the pretreated soiled/stained substrate in conventional manner. More preferably, pretreatment times will range from about 1 to 180 minutes.

The following examples are meant to exemplify compositions of the present invention, but are not necessarily meant to limit or otherwise define the scope of the invention.

In all of the following examples Protease¹ means a protease variant comprising substitution of amino acid residues with another naturally occurring amino acid residue at positions corresponding to positions 101G/103A/104I/159D/232V/236H/245R/248D/252K of *Bacillus amyloliquefaciens* subtilisin. Protease¹ can be substituted with any other

additional protease variant of the present invention, with substantially similar results in the following examples.

In the cleaning composition examples of the present invention, the Protease¹ enzyme levels are expressed by pure enzyme by weight of the total composition, the other enzyme levels are expressed by raw material by weight of the total composition, and unless otherwise specified, the other ingredients are expressed by weight of the total composition.

Further, in the following examples some abbreviations known to those of ordinary skill in the art are used, consistent with the disclosure set forth herein.

Example 1
Granular Automatic Dishwashing Composition

Component	Δ	Β	Γ
Citric Acid	15.0	-	-
Citrate	4.0	29.0	15.0
Acrylate/methacrylate copolymer	6.0	-	6.0
Acrylic acid maleic acid copolymer	-	3.7	-
Dry add carbonate	9.0	-	20.0
Alkali metal silicate	8.5	17.0	9.0
Paraffin	-	0.5	-
Benzotriazole	-	0.3	-
Ternamyl 60T	1.6	1.6	1.6
Protease ¹	0.2	0.1	0.06
Percarbonate (AvO)	1.5	-	-
Perborate monohydrate	-	0.3	1.5
Perborate tetrahydrate	-	0.9	-
NOBS	-	-	2.40
TAED	3.8	4.4	-
Diethylene triamine penta methyl phosphonic acid (Mg salt)	0.13	0.13	0.13
Alkyl ethoxy sulphate - 3 times ethoxylated	3.0	-	-
Alkyl ethoxy propoxy nonionic surfactant	-	1.5	-
Suds suppressor	2.0	-	-
Olin SLF 18 nonionic surfactant	-	-	2.0
Sulfate (Balance 100%)			

Example 2

Compact high density (0.96Kg/l) dishwashing detergent compositions A to F in accordance with the invention:

Component	A	B	C	D	E	F
STPP	-	51.4	51.4	-	-	44.3
Citrate	17.05	-	-	49.6	40.2	-
Carbonate	17.50	14.0	20.0		8.0	33.6
Bicarbonate	-	-	-	26.0	-	-
Silicate	14.81	15.0	8.0	-	25.0	3.6
Metasilicate	2.50	4.5	4.5	-	-	-
PB1	9.74	7.79	7.79	-	-	-
PB4	-	-	-	9.6	-	-
Percarbonate	-	-	-	-	11.8	4.8
Nonionic	2.00	1.50	1.50	2.6	1.9	5.9
TAED	2.39	-	-	3.8	-	1.4
HEDP	1.00	-	-	-	-	-
DETPMP	0.65	-	-	-	-	-
Mn TACN	-	-	-	-	0.008	-
NOBS	-	2.40	-	-	-	-
PAAC	-	-	0.008	-	-	-
Paraffio	0.50	0.38	0.38	0.6	-	-
Protease ¹	0.1	0.06	0.05	0.03	0.07	0.01
Amylase	1.5	1.5	1.5	2.6	2.1	0.8
BTA	0.30	0.22	0.22	0.3	0.3	0.3
Polycarboxylate	6.0	-	-	-	4.2	0.9
Perfume	0.2	0.12	0.12	0.2	0.2	0.2
Sulfate / Water	20.57	1.97	2.97	3.6	4.5	3.9
pH (1% solution)	11.0	11.0	11.3	9.6	10.8	10.9

Example 3

Granular dishwashing detergent compositions examples A to F of bulk density 1.02Kg/L in accordance with the invention:

Component	A	B	C	D	E	F
STPP	30.00	33.5	27.9	29.62	33.8	22.0
Carbonate	30.50	30.50	30.5	23.00	34.5	45.0
Silicate	7.40	7.50	12.6	13.3	3.2	6.2

Metasilicate	-	4.5					
Percarbonate	-	-		-	4.0		
PB1	4.4	4.5	4.3	-	-		
NaDCC	-	-		2.00	-	0.9	
Nonionic	1.0	0.75	1.0	1.90	0.7	0.5	
TAED	1.00	-		-	-		
NOBS	-	-	-	-	2.0	-	
PAAC	-	0.004		-	-		
Paraffin	0.25	0.25		-	-		
Protease ¹	0.05	0.06	0.025	0.1	0.02	0.07	
Amylase	0.38	0.64	0.46	-	0.6		
BTA	0.15	0.15		-	0.2		
Perfume	0.2	0.2	0.05	0.1	0.2		
Sulfate/water	23.45	16.87	22.26	30.08	21.7	25.4	
pH (1% solution)	10.80	11.3	11.0	10.70	11.5	10.9	

Example 4

Tablet detergent composition examples A to H in accordance with the present invention are prepared by compression of a granular dishwashing detergent composition at a pressure of 13KN/cm² using a standard 12 head rotary press:

Component	A	B	C	D	E	F	G	H
STPP	-	48.8	54.7	38.2	-	52.4	56.	36.
							1	0
Citrate	20.0	-	-	-	35.9	-	-	-
Carbonate	20.0	5.0	14.0	15.4	8.0	23.0	20.	28.
							0	0
Silicate	15.0	14.8	15.0	12.6	23.4	2.9	4.3	4.2
Protease ¹	0.05	0.09	0.05	0.03	0.06	0.03	0.0	0.1
							3	
Amylase	1.5	1.5	1.5	0.85	1.9	0.4	2.1	0.3
PB1	14.3	7.8	11.7	12.2	-	-	6.7	8.5
PB4	-	-	-	-	22.8	-	3.4	-
Percarbonate	-	-	-	-	-	10.4	-	-
Nonionic	1.5	2.0	2.0	2.2	1.0	4.2	4.0	6.5
PAAC	-	-	0.016	0.009	-	-	-	-
MnTACN	-	-	-	-	0.007	-	-	-

TAED	2.7	2.4	-	-	-	2.1	0.7	1.6
HEDP	1.0	-	-	0.93	-	0.4	0.2	-
DETPMP	0.7	-	-	-	-	-	-	-
Paraffin	0.4	0.5	0.5	0.55	-	-	0.5	-
BTA	0.2	0.3	0.3	0.33	0.3	0.3	0.3	-
Polycarboxylate	4.0	-	-	-	4.9	0.6	0.8	-
PEG	-	-	-	-	-	2.0	-	2.0
Glycerol	-	-	-	-	-	0.4	-	0.5
Perfume	-	-	-	0.05	0.20	0.2	0.2	0.2
Sulfate / water	17.4	14.7	-	15.74	-	-	-	11. 3
weight of tablet	20g	25g	20g	30g	18g	20g	25g	24. 0
pH (1% solution)	10.7 0	10.6	10.7	10.7	10.9	11.2	11. 0	10. 8

Examples 5
Granular Fabric Cleaning Compositions

Components	Example No.	
	A	B
Linear alkyl benzene sulphonate	11.4	10.70
Tallow alkyl sulphate	1.80	2.40
C ₁₄₋₁₅ alkyl sulphate	3.00	3.10
C ₁₄₋₁₅ alcohol 7 times ethoxylated	4.00	4.00
Tallow alcohol 11 times ethoxylated	1.80	1.80
Dispersant	0.07	0.1
Silicone fluid	0.80	0.80
Trisodium citrate	14.00	15.00
Citric acid	3.00	2.50
Zeolite	32.50	32.10
Maleic acid acrylic acid copolymer	5.00	5.00

Diethylene triamine penta methylene phosphonic acid	1.00	0.20
Protease [†]	0.1	0.01
Lipase	0.36	0.40
Amylase	0.30	0.30
Sodium silicate	2.00	2.50
Sodium sulphate	3.50	5.20
Polyvinyl pyrrolidone	0.30	0.50
Perborate	0.5	1
TAED	1.0	-
NOBS	-	1.0
Phenol sulphonate	0.1	-
Peroxidase	0.1	0.1
Minors	Up to 100	Up to 100

Examples 6Granular Fabric Cleaning Compositions

Components	Example No.	
	A	B
Sodium linear C ₁₂ alkyl benzene-sulfonate	6.5	8.0
Sodium sulfate	15.0	18.0
Zeolite A	26.0	22.0
Sodium nitrilotriacetate	5.0	5.0
Polyvinyl pyrrolidone	0.5	0.7
TAED	3.0	-
NOBS	-	2.4
Boric acid	4.0	-
Perborate	0.5	1
Phenol sulphonate	0.1	-
Protease [†]	0.02	0.05

Fillers (e.g., silicates; carbonates; perfumes; water)	Up to 100	Up to 100
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Example 7
Compact Granular Fabric Cleaning Composition

<u>Components</u>	<u>Weight %</u>
Alkyl Sulphate	8.0
Alkyl Ethoxy Sulphate	2.0
Mixture of C25 and C45 alcohol 3 and 7 times ethoxylated	6.0
Polyhydroxy fatty acid amide	2.5
Zeolite	17.0
Layered silicate/citrate	16.0
Carbonate	7.0
Maleic acid acrylic acid copolymer	5.0
Soil release polymer	0.4
Carboxymethyl cellulose	0.4
Poly (4-vinylpyridine) -N-oxide	0.1
Copolymer of vinylimidazole and vinylpyrrolidone	0.1
PEG2000	0.2
Protease ¹	0.03
Lipase	0.2
Cellulase	0.2
TAED	6.0
Percarbonate	22.0
Ethylene diamine disuccinic acid	0.3
Suds suppressor	3.5
Disodium-4,4'-bis (2-morpholino -4-anilino-s-triazin-6-ylamino) stilbene-2,2'-disulphonate	0.25
Disodium-4,4'-bis (2-sulfostyryl) biphenyl	0.05
Water, Perfume and Minors	Up to 100

Example 8
Granular Fabric Cleaning Composition

<u>Component</u>	<u>Weight %</u>
Linear alkyl benzene sulphonate	7.6
C ₁₆ -C ₁₈ alkyl sulfate	1.3

C ₁₄₋₁₅ alcohol 7 times ethoxylated	4.0
Coco-alkyl-dimethyl hydroxyethyl ammonium chloride	1.4
Dispersant	0.07
Silicone fluid	0.8
Trisodium citrate	5.0
Zeolite 4A	15.0
Maleic acid acrylic acid copolymer	4.0
Diethylene triamine penta methylene phosphonic acid	0.4
Perborate	15.0
TAED	5.0
Smectite clay	10.0
Poly (oxy ethylene) (MW 300,000)	0.3
Protease ¹	0.02
Lipase	0.2
Amylase	0.3
Cellulase	0.2
Sodium silicate	3.0
Sodium carbonate	10.0
Carboxymethyl cellulose	0.2
Brighteners	0.2
Water, perfume and minors	Up to 100

Example 9
Granular Fabric Cleaning Composition

<u>Component</u>	<u>Weight %</u>
Linear alkyl benzene sulfonate	6.92
Tallow alkyl sulfate	2.05
C ₁₄₋₁₅ alcohol 7 times ethoxylated	4.4
C ₁₂₋₁₅ alkyl ethoxy sulfate - 3 times ethoxylated	0.16
Zeolite	20.2
Citrate	5.5
Carbonate	15.4
Silicate	3.0

Maleic acid acrylic acid copolymer	4.0
Carboxymethyl cellulase	0.31
Soil release polymer	0.30
Proteins ¹	0.1
Lipase	0.36
Cellulase	0.13
Perborate tetrahydrate	11.64
Perborate monohydrate	8.7
TAED	5.0
Diethylene tramine penta methyl phosphonic acid	0.38
Magnesium sulfate	0.40
Brightener	0.19
Perfume, silicone, suds suppressors	0.85
Minors	Up to 100

Example 10
Granular Fabric Cleaning Composition

Component	A	B	C
Base Granule Components			
LAS/AS/AES (65/35)	9.95	-	-
LAS/AS/AES (70/30)	-	12.05	7.70
Alumino silicate	14.06	15.74	17.10
Sodium carbonate	11.86	12.74	13.07
Sodium silicate	0.58	0.58	0.58
NaPAA Solids	2.26	2.26	1.47
PEG Solids	1.01	1.12	0.66
Brighteners	0.17	0.17	0.11
DTPA	-	-	0.70
Sulfate	5.46	6.64	4.25
DC-1400 Deaerant	0.02	0.02	0.02
Moisture	3.73	3.98	4.33
Minors	0.31	0.49	0.31

B.O.T. Spray-on			
Nonionic surfactant	0.50	0.50	0.50
Agglomerate Components			
LAS/AS (25/75)	11.70	9.60	10.47
Alumino silicate	13.73	11.26	12.28
Carbonate	8.11	6.66	7.26
PEG 4000	0.59	0.48	0.52
Moisture/Minors	4.88	4.00	4.36
Functional Additives			
Sodium carbonate	7.37	6.98	7.45
Perborate	1.03	1.03	2.56
AC Base Coating	-	1.00	-
NOBS	-	-	2.40
Soil release polymer	0.41	0.41	0.31
Cellulase	0.33	0.33	0.24
Protease ^f	0.1	0.05	0.15
AE-Flake	0.40	0.40	0.29
Liquid Spray-on			
Perfume	0.42	0.42	0.42
Nonionic spray-on	1.00	1.00	0.50
Minors	Up to 100		

Example 11
Granular Fabric Cleaning Composition

	A	B
Surfactant		
- Na LAS	6.40	-
- KLAS	-	9.90
- AS/AE3S	6.40	4.39
- TAS	0.08	0.11
- C24AE5	3.48	-
- Genagen	-	1.88
- N-ocetyl N-methyl glucamine (lin)	1.14	2.82

- C8-10 dimethyl hydroxyethyl ammonium chloride	1.00	1.40
Builder		
- Zeofite	20.59	13.39
- SKS-6	10.84	10.78
- Citric Acid	2.00	-
Buffer		
- Carbonate	9.60	12.07
- Bicarbonate	2.00	2.00
- Sulphate	2.64	-
- Silicate	0.61	0.16
Polymer		
- Acrylic acid/maleic acid copolymer (Na)	1.17	1.12
- CMC	0.45	0.24
- Polymer	0.34	0.18
- Hexamethylene-diamine-tetra-E24 ethoxylate; diquaternized with methyl chloride	1.00	1.00
Enzyme		
- Protease (% pure enzyme)	0.03	0.03
- Cellulase	0.26	0.26
- Amylase	0.65	0.73
- Lipase	0.27	0.15
Bleach		
- TAED (100%)	3.85	3.50
- Phenolsulfonate ester of N-nonanoyl-6-aminocaproic acid	-	2.75
- Percarbonate	16.20	18.30
- HEDP	0.48	0.48
- EDDS	0.30	0.30
Miscellaneous		

- Malic particle		2.20 + bicarb
- Brightener 1S/49	0.077/0.014	0.07/0.014
- Zinc phthalecyanine sulfonate	0.0026	0.0026
- Polydimethylsiloxane with trimethylsilyl end blocking units	0.25	0.24
- Soap	-	1.00
- Perfume	0.45	0.55
TOTAL	100	100

Example 12
Granular Fabric Cleaning Composition

	A	B
Surfactant		
NaLAS	6.8	0.4
KLAS	-	10.9
FAS	0.9	0.1
AS	0.6	1.5
C25AE3S	0.1	-
AES	4.2	-
N-Cocoyl-N-Methyl Glucamine	-	1.8
Genagen	-	1.2
C8-10 dimethyl hydroxyethyl ammonium chloride	-	1.0
Builder		
SKS-6	3.3	9.0
Zeolite	17.2	18.9
Citric Acid	1.5	-
Buffer		
Carbonate	21.1	15.0
Sodium Bicarbonate	-	2.6
Sulphate	15.2	5.5
Malic Acid	-	2.9
Silicate	0.1	-
Polymer		

Acrylic acid/maleic acid copolymer (Na)	2.2	0.9
Hexamethylene-diamine tetra-E24 ethoxylate, diquaternized with methyl chloride	0.5	0.7
Polymer	0.1	0.1
CMC	0.2	0.1
Enzymes		
Protease ^j (% pure enzyme)	0.02	0.05
Lipase	0.18	0.14
Amylase	0.64	0.73
Cellulase	0.13	0.26
Bleach		
TAED	2.2	2.5
Phenolsulfonate ester of N-nonaoyl- 6-aminocaproic acid	-	1.96
Sodium Percarbonate	-	13.1
PB4	15.6	-
EDDS	0.17	0.21
MgSO ₄	0.35	0.47
HEDP	0.15	0.34
Brightener		
- Zinc phthalocyanine sulfonate	0.0015	0.0020
- Polydimethylsiloxane with trimethylsilyl end blocking units	0.04	0.14
Soap	0.5	0.7
Perfume	0.35	0.45
Speckle	0.5	0.6

Examples 13

Granular laundry detergent compositions I3 A-C in accordance with the present invention are of particular utility under European machine wash conditions:

Component	A	B	C
LAS	7.0	5.61	4.76
TAS	-	-	1.57

C45AS	6.0	2.24	3.89
C25E3S	1.0	0.76	1.18
C45E7	-	-	2.0
C25E3	4.0	5.5	-
QAS	0.8	2.0	2.0
STPP	-	-	-
Zeolite A	25.0	19.5	19.5
Citric acid	2.0	2.0	2.0
NaSKS-6	8.0	10.6	10.6
Carbonate I	8.0	10.0	8.6
MA/AA	1.0	2.6	1.6
CMC	0.5	0.4	0.4
PB4	-	12.7	-
Percarbonate	-	-	19.7
TAED	-	3.1	5.0
Citrate	7.0	-	-
DTPMP	0.25	0.2	0.2
HEDP	0.3	0.3	0.3
QEA I	0.9	1.2	1.0
Protease ^b	0.02	0.05	0.035
Lipase	0.15	0.25	0.15
Cellulase	0.28	0.28	0.28
Amylase	0.4	0.7	0.3
PVPI/ PVNO	0.4	-	0.1
Photoactivated bleach (ppm)	15 ppm	27 ppm	27 ppm
Brightener 1	0.08	0.19	0.19
Brightener 2	-	0.04	0.04

Perfume	0.3	0.3	0.3
Effervescent granules (malic acid 40%, sodium bicarbonate 40%, sodium carbonate 20%)	15	15	5
Silicone antifoam	0.5	2.4	2.4
Minors/inerts to 100%			

Example 14

The following formulations are examples of compositions in accordance with the invention, which may be in the form of granules or in the form of a tablet.

Component	14
C45 AS/TAS	3.0
LAS	8.0
C25AE3S	1.0
NaSKS-6	9.0
C25AE5/AE3	5.0
Zeolite A	10.0
SKS-6 (l) (dry add)	2.0
MA/AA	2.0
Citric acid	1.5
EDDS	0.5
HEDP	0.2
PBI	10.0
NACA OBS	2.0
TARD	2.0
Carbonate	8.0
Sulphate	2.0
Amylase	0.3
Lipase	0.2
Protease ^t	0.02
Minors (Brightener/SRP1/CMC/Photobleach/ MgSO ₄ /PVPVI/Suds suppressor/PEG)	0.5

Perfume	0.5
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Example 15
Liquid Fabric Cleaning Compositions

Component	<u>Example No.</u>	
	A	B
C ₁₂₋₁₄ alkenyl succinic acid	3.0	8.0
Citric acid monohydrate	10.0	15.0
Sodium C ₁₂₋₁₅ alkyl sulphate	8.0	8.0
Sodium sulfate of C ₁₂₋₁₅ alcohol 2 times ethoxylated	-	3.0
C ₁₂₋₁₅ alcohol 7 times ethoxylated	-	8.0
C ₁₂₋₁₅ alcohol 5 times ethoxylated	8.0	-
Diethylene triamine penta (methylene phosphonic acid)	0.2	-
Oleic acid	1.8	-
Ethanol	4.0	4.0
Propanediol	2.0	2.0
Protease ¹	0.01	0.02
Suds suppressor	0.15	0.15
NaOH	up to pH 7.5	
Perborate	0.5	1
Phenol sulphonate	0.1	0.2
Peroxidase	0.4	0.1
Waters and minors	up to 100 %	

Example 16
Liquid Fabric Cleaning Compositions

Component	<u>Example No.</u>
NaLAS (100%am)	12
Neodol	16
EDDS	21.5
Dispersant	1.2
Perborate	1.3
Phenolsulfonate ester of N-nonanoyl-6-aminocaproic acid	12
Protease ¹ (% pure enzyme)	0.03

Cellulase	0.03
Solvent (BPP)	18.5
Polymer	0.1
Carbonate	10
FWA 15	0.2
TiO ₂	0.5
PEG 8000	0.4
Perfume	1.0-1.2
Suds suppressor	0.06
Waters and minors	up to 100%

Example 17
Two-layer Effervescent Denture Cleansing Tablets

Component	Example No.			
	A	B	C	D
Acidic Layer				
Protease ¹	1.0	1.5	0.01	0.05
Tartaric acid	24.0	24.0	24.00	24.00
Sodium carbonate	4.0	4.0	4.00	4.00
Sulphamic acid	10.0	10.0	10.00	10.00
PEG 20,000	4.0	4.0	4.00	4.00
Sodium bicarbonate	24.5	24.5	24.50	24.50
Potassium persulfate	15.0	15.0	15.00	15.00
Sodium acid pyrophosphate	7.0	7.0	7.00	7.00
Pyrogenic silica	2.0	2.0	2.00	2.00
Tetracetylethylene diamine	7.0	7.0	7.00	7.00
Flavor	1.0	1.0	1.00	1.00
Alkaline Layer				
Sodium perborate monohydrate	32.0	32.0	32.00	32.00
Sodium bicarbonate	19.0	19.0	19.00	19.00
EDTA	3.0	3.0	3.00	3.00
Sodium tripolyphosphate	12.0	12.0	12.00	12.00
PEG 20,000	2.0	2.0	2.00	2.00

Sodium carbonate	2.0	2.0	2.00	2.00
Pyrogenic silica	2.0	2.0	2.00	2.00
Dye/flavor	2.0	2.0	2.00	2.00

Example 18

Granular laundry detergent compositions 18 A-E are of particular utility under Japanese machine wash conditions and are prepared in accordance with the invention:

Component	A	B	C	D	E
LAS	23.57	23.57	21.67	21.68	21.68
FAS	4.16	4.16	3.83	3.83	3.83
Nonionic surfactant	3.30	3.30	2.94	3.27	3.27
Bis (hydroxyethyl) methyl alkyl ammonium chloride	0.47	0.47	1.20	1.20	1.20
SKS-6	7.50	7.50	5.17	5.76	5.06
Polyacrylate copolymer (MW 11000) (maleic/acrylate ratio of 4:6)	7.03	7.03	14.36	14.36	14.36
Zeolite	11.90	11.40	10.69	11.34	11.34
Carbonate	14.90	14.82	11.71	11.18	11.18
Silicate	12.00	12.00	12.37	12.38	12.38
Protease ¹	0.016	0.016	0.046	0.046	0.046
Lipase	-	-	0.28	-	-
Amylase	-	-	0.62	-	-
Cellulase	-	-	0.48	-	0.70
NOBS	3.75	3.75	2.70	2.70	2.70

PBI	3.53	-	2.60	-	-
Sodium percarbonate	-	4.21	-	3.16	3.16
SRP	0.52	0.52	0.70	0.70	0.70
Brightener	0.31	0.31	0.28	0.28	0.50
AE-coflake	0.17	0.20	0.17	0.17	0.17
Polydimethylsiloxane	-	-	0.68	0.68	0.68
Perfume	0.06	0.06	0.08	-	-
Perfume	-	-	-	0.23	0.23
Hydrophobic precipitated silica	0.30	0.30	0.30	0.30	0.30
PEG4000	0.19	0.19	0.17	0.17	0.17
Minors/inerts to 100%					

While particular embodiments of the subject invention have been described, it will be obvious to those skilled in the art that various changes and modifications of the subject invention can be made without departing from the spirit and scope of the invention. It is intended to cover, in the appended claims, all such modifications that are within the scope of the invention.

The compositions of the present invention can be suitably prepared by any process chosen by the formulator, non-limiting examples of which are described in U.S. Patent Nos. 5,691,297; 5,574,005; 5,569,645; 5,565,422; 5,516,448; 5,489,392; and 5,486,303.

In addition to the above examples, the bleaching compositions of the present invention can be formulated into any suitable laundry detergent composition, non-limiting examples of which are described in U.S. Patent Nos. 5,679,630; 5,565,145; 5,478,489; 5,470,507; 5,466,802; 5,460,752; 5,458,810; 5,458,809; and 5,288,431.

Having described the invention in detail with reference to preferred embodiments and the examples, it will be clear to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention and the invention is not to be considered limited to what is described in the specification.

WHAT IS CLAIMED IS:

1. A bleaching composition comprising:
 - (a) an effective amount of a protease variant wherein said protease variant includes a substitution of an amino acid residue with another naturally occurring amino acid residue at an amino acid residue position corresponding to position 103 of *Bacillus amyloliquefaciens* subtilisin in combination with a substitution of an amino acid residue with another naturally occurring amino acid residue at one or more amino acid residue positions corresponding to positions 1, 3, 4, 8, 9, 10, 12, 13, 16, 17, 18, 19, 20, 21, 22, 24, 27, 33, 37, 38, 42, 43, 48, 55, 57, 58, 61, 62, 68, 72, 75, 76, 77, 78, 79, 86, 87, 89, 97, 98, 99, 101, 102, 104, 106, 107, 109, 111, 114, 116, 117, 119, 121, 123, 126, 128, 130, 131, 133, 134, 137, 140, 141, 142, 146, 147, 158, 159, 160, 166, 167, 170, 173, 174, 177, 181, 182, 183, 184, 185, 188, 192, 194, 198, 203, 204, 205, 206, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 222, 224, 227, 228, 230, 232, 236, 237, 238, 240, 242, 243, 244, 245, 246, 247, 248, 249, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 265, 268, 269, 270, 271, 272, 274 and 275 of *Bacillus amyloliquefaciens* subtilisin; wherein when said protease variant includes a substitution of amino acid residues at positions corresponding to positions 103 and 76, there is also a substitution of an amino acid residue at one or more amino acid residue positions other than amino acid residue positions corresponding to positions 27, 99, 101, 104, 107, 109, 123, 128, 166, 204, 206, 210, 216, 217, 218, 222, 260, 265 or 274 of *Bacillus amyloliquefaciens* subtilisin;
 - (b) a bleaching agent which either is an organic peroxyacid or is a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid in situ in a bleaching solution formed from the composition; and
 - (c) one or more cleaning adjunct materials.
2. The bleaching composition according to Claim 1 wherein said protease variant is derived from a *Bacillus* subtilisin, preferably *Bacillus licheniformis* subtilisin 309.
3. The bleaching composition according to Claim 1 wherein said protease variant includes substitutions of the amino acid residues at position 103 and at one or more of the following positions 236 and 245, preferably at positions 103 and 236 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 211, 212, 213, 215, 217, 230, 232, 248, 252, 257, 260, 270 and 275 or at positions 103 and 245 and at one or more of the following positions 12, 61, 62, 68, 76,

97, 98, 101, 102, 104, 109, 130, 131, 159, 170, 183, 185, 205, 209, 210, 211, 212, 213, 215, 217, 222, 230, 232, 248, 252, 257, 260, 261, 270 and 275, more preferably at positions 103, 236 and 245 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 211, 212, 213, 215, 217, 230, 232, 248, 252, 257, 260, 270 and 275.

4. The bleaching composition according to Claim 1 wherein said protease variant includes a substitution set selected from the group consisting of:

12/102/103/104/159/212/232/236/245/248/252; 12/76/103/104/130/170/185/222/243/245;
12/76/103/104/130/222/245/261; 12/76/103/104/222/245;
12/76/103/104/130/222/245;
61/68/103/104/159/232/236/245/248/252; 62/103/104/159/213/233/236/245/248/252;
62/103/104/109/159/213/232/236/245/248/252; 62/103/104/159/232/236/245/248/252;
62/101/103/104/159/212/213/232/236/245/248/252;
62/103/104/130/159/213/232/236/245/248/252;
68/103/104/159/232/236/245/248/252/270;
68/103/104/159/185/232/236/245/248/252; 68/103/104/159/210/232/236/245/248/252;
68/103/104/159/185/210/232/236/245/248/252; 68/103/104/159/213/232/236/245/248/252;
68/103/104/159/230/232/236/245; 68/76/103/104/159/209/232/236/245;
68/103/104/232/236/245/248/257/275; 68/103/104/213/232/236/245/248/252;
68/103/104/159/232/236/245/248/252; 68/103/104/159/209/232/236/245;
68/76/103/104/159/236; 68/76/103/104/159/236/245;
68/76/103/104/159/232/236/245; 68/103/104/159/232/236/245/252;
68/103/104/159/232/236/245; 68/103/104/159/232/236/245/257;
68/76/103/104/159/211/232/236/245; 68/76/103/104/159/215/232/236/245;
68/103/104/159/210/232/236/245; 68/103/104/159/213/232/236/245/260;
68/76/103/104/159/213/232/236/245/260; 68/103/104/159/236;
68/76/103/104/159/210/232/236/245/260; 68/103/104/159/236/245;
68/103/104/159/183/232/236/245/248/252; 68/76/103/104/159/236/245;
68/103/104/232/236/245/257/275; 68/103/104/159/213/232/236/245;
76/103/222/245; 76/103/104/159/232/236/245;
76/103/104/159/213/232/236/245/260; 76/103/104/159;
76/103/104/131/159/232/236/245/248/252; 76/103/104/222/245;
97/103/104/159/232/236/245/248/252;
98/102/103/104/159/212/232/236/245/248/252; 98/103/104/159/232/236/245/248/252;

101/103/104/159/232/236/245/248/252; 102/103/104/159/232/236/245/248/252;
103/104/159/232/236/245; 103/104/159/232/236/245/248/252;
103/104/159/205/209/232/236/245/257; 103/104/159/232/236/245/248/252;
103/104/159/205/209/210/232/236/245/257; 103/104/159/213/232/236/245/248/252;
103/104/159/217/232/236/245/248/252; 103/104/130/159/232/236/245/248/252;
103/104/159/230/236/245; 103/104/159/236/245;
103/104/159/248/252/270; 103/104/131/159/232/236/245/248/252;
103/104/159/205/209/232/236/245; and 103/104/159/232/236/245/257.

5. The bleaching composition according to Claim 4 wherein said protease variant includes a substitution set selected from the group consisting of:

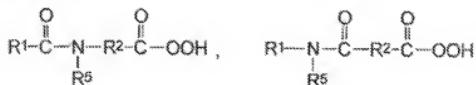
12R/76D/103A/104T/130T/222S/245R;
12R/76D/103A/104I/222S/245R;
12R/102A/103A/104I/159D/212G/232V/236H/245R/248D/252K;
12R/76D/103A/104T/130G/222S/245R/261D;
12R/76D/103A/104T/130G/170S/185D/222S/243D/245R;
61E/68A/103A/104I/159D/232V/236H/245R/248D/252K;
62D/103A/104I/109R/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/212G/213R/232V/236H/245R/248D/252K;
62D/101G/103A/104I/159D/213R/232V/236H/245R/248D/252K;
68A/76D/103A/104I/159D/213R/232V/236H/245R/260A;
68A/103A/104I/159D/236H;
68A/103A/104I/159D/236H/245R;
68A/76D/103A/104I/159D/210I/232V/236H/245R/260A;
68A/103A/104I/159D/183D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/209W/232V/236H/245R;
68A/76D/103A/104I/159D/211R/232V/236H/245R;
68A/76D/103A/104I/159D/215R/232V/236H/245R;
68A/103A/104I/159D/213R/232V/236H/245R/260A;
68A/76D/103A/104I/159D/236I;
68A/76D/103A/104I/159D/236H/245R;
68A/76D/103A/104I/159D/232V/236H/245R;
68A/103A/104I/159D/232V/236I/245R/252K;
68A/103A/104I/159D/232V/236H/245R;
68A/103A/104I/159D/232V/236H/245R/257V;

68A/103A/104I/159D/185D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/210L/232V/236H/245R/248D/252K;
68A/103A/104I/159D/185D/210L/232V/236H/245R/248D/252K;
68A/103A/104I/159D/213E/232V/236H/245R/248D/252K;
68A/103A/104I/159D/230V/232V/236H/245R;
68A/76D/103A/104I/159D/209W/232V/236H/245R;
68A/103A/104I/232V/236H/245R/248D/257V/275H;
68A/103A/104I/232V/236H/245R/257V/275H;
68A/103A/104I/213E/232V/236H/245R/248D/252K;
68A/103A/104I/159D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/210I/232V/236H/245R;
68A/103A/104I/159D/210L/232V/236H/245R;
68A/103A/104I/159D/213G/232V/236H/245R;
68A/103A/104I/159D/232V/236H/245R/248D/252K/270A;
76D/103A/222S/245R;
76D/103A/104I/159D/232V/236H/245R;
76D/103A/104I/159D;
76D/103A/104I/222S/245R;
76D/103A/104I/131V/159D/232V/236H/245R/248D/252K;
76D/103A/104I/159D/213R/232V/236H/245R/260A;
97E/103A/104I/159D/232V/236H/245R/248D/252K;
98L/103A/104I/159D/232V/236H/245R/248D/252K;
98L/102A/103A/104I/159D/212G/232V/236H/245R/248D/252K;
101G/103A/104I/159D/232V/236H/245R/248D/252K;
102A/103A/104I/159D/232Y/236H/245R/248D/252K;
103A/104I/159D/232V/236H/245R/248D/252K;
103A/104I/159D/213R/232V/236H/245R/248D/252K;
103A/104I/130G/159D/232V/236H/245R/248D/252K;
103A/104I/159D/230V/236H/245R;
103A/104I/159D/217E/232V/236H/245R/248D/252K;
103A/104I/159D/236H/245R;
103A/104I/159D/236I/245R;
103A/104I/159D/248D/252K/270V;
103A/104I/159D/232V/236H/245R;
103A/104I/159D/205I/209W/232V/236H/245R/257V;
103A/104I/159D/232V/236H/245R/257V;
103A/104I/131V/159D/232V/236H/245R/248D/252K;

103A/104I/159D/205I/209W/210I/232V/236H/245R/257V; and
103A/104I/159D/232V/245R/248D/252K.

6. The bleaching composition according to Claim 1 wherein said bleaching agent is selected from the group consisting of:

(i) an organic peroxyacid selected from the group consisting of organic peroxyacids of the formula:



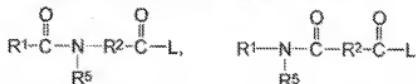
wherein R^1 is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R^2 is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, and R^5 is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms; E-phthalimidoo peroxyacrylic acids; and mixtures thereof; and

(ii) a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid in situ in a bleaching solution formed from the composition, wherein said bleach activator has the general formula:



wherein R is an alkyl group containing from about 5 to about 18 carbon atoms wherein the longest linear alkyl chain extending from and including the carbonyl carbon contains from about 6 to about 10 carbon atoms and L is a leaving group, the conjugate acid of which has a pKa in the range of from about 4 to about 13;

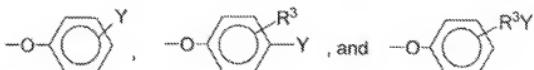
preferably said bleach activator has the general formula:



or mixtures thereof, wherein R^1 is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R^2 is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, R^5 is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms, and L is a leaving group;

more preferably R^1 is an alkyl group containing from about 6 to about 12 carbon atoms, R^2 contains from about 1 to about 8 carbon atoms, and R^5 is H or methyl.

7. The bleaching composition according to Claim 6 wherein R¹ is an alkyl group containing from about 7 to about 10 carbon atoms, R² contains from about 4 to about 5 carbon atoms, and wherein L is selected from the group consisting of:

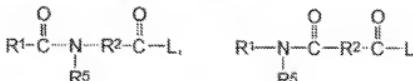


wherein R³ is an alkyl chain containing from about 1 to about 8 carbon atoms, and Y is -SO₃⁻M⁺ or -CO₂⁻M⁺ wherein M is sodium or potassium.

8. The bleaching composition according to Claim 1 wherein said bleaching agent comprises a bleach activator selected from the group consisting of tetraacetyl ethylene diamine (TAED), benzoylcyclactam (BzCL), 4-nitrobenzoylcyclactam, 3-chlorobenzoylcyclactam, benzoyloxybenzenesulphonate (BOBS), nonanoyloxybenzenesulphonate (NOBS), phenyl benzoate (PhBz), decanoxybenzenesulphonate (C₁₀-OBS), benzoylvalerolactam (BZVL), octanoyloxybenzenesulphonate (C₈-OBS), perhydrolyzable esters, 4-[N-(nonaoyl) amino hexanoyloxy]-benzene sulfonate sodium salt (NACA-OBS), lauryloxybenzenesulphonate (LOBS or C₁₂-OBS), 10-undecenoyloxybenzenesulfonate (UDOBS or C₁₁-OBS with unsaturation in the 10 position), and decanoxybenzoic acid (DOBA) and mixtures thereof, and further optionally comprises a bleach catalyst, preferably 3-(3,4-dihydroisoquinolinium) propane sulfonate.

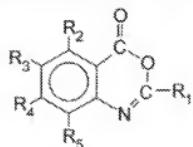
9. The bleaching composition according to Claim 1 wherein said bleaching agent comprises at least about 0.1% by weight of the bleaching agent of a peroxygen bleaching compound capable of yielding hydrogen peroxide in an aqueous liquor and at least 0.1% by weight of the bleaching agent of one or more bleach activators, wherein said bleach activators are members selected from the group consisting of:

a) a bleach activator of the general formula:



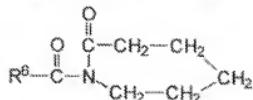
or mixtures thereof, wherein R¹ is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R² is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, R⁵ is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms, and L is a leaving group;

b) a benzoxazin-type bleach activator of the formula:



wherein R1 is H, alkyl, alkaryl, aryl, arylalkyl, and wherein R2, R3, R4, and R5 may be the same or different substituents selected from H, halogen, alkyl, alkenyl, aryl, hydroxyl, alkoxyl, amino, alkylamino, -COOR₆, wherein R₆ is H or an alkyl group and carbonyl functions;

c) a N-acyl caprolactam bleach activator of the formula:



wherein R⁶ is H or an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to 12 carbons; and

d) mixtures of a), b) and c).

10. The bleaching composition according to Claim 1 wherein the corresponding carboxylic acid of the organic peroxyacid bleaching agent has a Hydrophilic-Lipophilic Balance value within the range of from about 3 to about 6.5.

11. The bleaching composition according to Claim 1 wherein said cleaning adjunct materials are selected from the group consisting of surfactants, solvents, buffers, enzymes, soil release agents, clay soil removal agents, dispersing agents, brighteners, suds suppressors, fabric softeners, suds boosters, enzyme stabilizers, builders, other bleaching agents, dyes, perfumes, chelants and mixtures thereof.

12. The bleaching composition according to Claim 11 wherein said cleaning adjunct materials comprise at least one deterutive surfactant, preferably a branched surfactant, more preferably a mid-chained branched surfactant.

13. The bleaching composition according to Claim 11 wherein the cleaning adjunct materials comprise at least about 0.1% surfactant by weight of the composition, said surfactant comprising materials selected from the group consisting of alkyl benzene

sulfonates, primary alkyl sulfates, secondary alkyl sulfates, alkyl alkoxy sulfates, alkyl alkoxy carboxylates, alkyl polyglycosides and their corresponding sulfated polyglycosides, alpha-sulfonated fatty acid esters, alkyl and alkyl phenol alkoxylates, betaines and sulfobetaines, amine oxides, N-methyl glucamides, nonionic primary alcohol ethoxylates, nonionic primary alcohol mixed ethoxy/propoxy, and mixtures thereof.

14. The bleaching composition according to Claim 13 further comprising at least about 5% builder selected from the group consisting of zeolites, polycarboxylates, layered silicates, phosphates, and mixtures thereof.

15. The bleaching composition according to Claim 11 wherein said cleaning adjunct materials comprise at least one deterotive enzyme selected from the group consisting of cellulases, lipases, amylases, phospholipases, other proteases, peroxidases and mixtures thereof.

16. The bleaching composition according to Claim 1 wherein said bleaching composition is a fabric bleaching composition, preferably in the form of a liquid, granule, tablet, powder or bar, comprising at least about 5% surfactant and at least about 5% builder by weight of the composition.

17. The bleaching composition according to Claim 1 wherein said bleaching composition is a fabric bleaching composition comprising:

- (a) from about 0.0001% to about 10% by weight of said protease variant;
- (b) from about 0.5% to about 20% by weight of said bleaching agent;
- (c) at least about 5% by weight of a surfactant preferably selected from the group consisting of alkyl benzene sulfonates, primary alkyl sulfates, secondary alkyl sulfates, alkyl alkoxy sulfates, alkyl alkoxy carboxylates, alkyl polyglycosides and their corresponding sulfated polyglycosides, alpha-sulfonated fatty acid esters, alkyl and alkyl phenol alkoxylates, betaines and sulfobetaines, amine oxides, N-methyl glucamides, nonionic primary alcohol ethoxylates, nonionic primary alcohol mixed ethoxy/propoxy, and mixtures thereof; and
- (d) at least about 5% by weight of a builder preferably selected from the group consisting of zeolites, polycarboxylates, layered silicates, phosphates, and mixtures thereof.

18. The bleaching composition according to Claim 17 is in the form of a concentrated granular fabric bleaching composition comprising at least about 15% surfactant.

19. A method for cleaning fabric, said method comprising contacting a fabric in need of cleaning with a bleaching composition according to Claims 16 or 17.

20. The bleaching composition according to Claim 1 wherein said bleaching composition is a dishwashing bleaching composition, preferably in the form of a liquid, granule, powder or tablet, comprising:

- (a) from about 0.0001% to about 10% by weight of the dishwashing bleaching composition of said protease variant;
- (b) from about 0.5% to about 20% by weight of the dishwashing bleaching composition of said bleaching agent
- (c) from about 0.1% to about 10% by weight of the dishwashing bleaching composition of a surfactant.

21. A method for cleaning dishes, said method comprising contacting a dish in need of cleaning with a bleaching composition according to Claim 20.

22. The bleaching composition according to Claim 1 wherein said bleaching composition is a personal cleansing composition comprising:

- (a) from about 0.001% to about 5%, preferably from about 0.001% to about 2%, more preferably from about 0.01% to about 0.8% by weight of the personal cleansing composition of a protease variant wherein said protease variant includes a substitution of an amino acid residue with another naturally occurring amino acid residue at an amino acid residue position corresponding to position 103 of *Bacillus amyloliquefaciens* subtilisin in combination with a substitution of an amino acid residue with another naturally occurring amino acid residue at one or more amino acid residue positions corresponding to positions 1, 3, 4, 8, 9, 10, 12, 13, 16, 17, 18, 19, 20, 21, 22, 24, 27, 33, 37, 38, 42, 43, 48, 55, 57, 58, 61, 62, 68, 72, 75, 76, 77, 78, 79, 86, 87, 89, 97, 98, 99, 101, 102, 104, 106, 107, 109, 111, 114, 116, 117, 119, 121, 123, 126, 128, 130, 131, 133, 134, 137, 140, 141, 142, 146, 147, 158, 159, 160, 166, 167, 170, 173, 174, 177, 181, 182, 183, 184, 185, 188, 192, 194, 198, 203, 204, 205, 206, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 222, 224, 227, 228, 230, 232, 236, 237, 238, 240, 242, 243, 244, 245, 246, 247, 248, 249, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 265, 268, 269, 270, 271, 272, 274 and 275 of *Bacillus amyloliquefaciens* subtilisin; wherein when said protease variant includes a substitution of amino acid residues at positions corresponding to positions 103 and 76, there is also a substitution of an amino acid residue at one or more amino acid residue positions other than amino acid residue positions corresponding to positions 27, 99, 101, 104, 107,

109, 123, 128, 166, 204, 206, 210, 216, 217, 218, 222, 260, 265 or 274 of *Bacillus amyloliquefaciens* subtilisin;

(b) from about 0.5% to about 20% by weight of the personal cleansing composition of a bleaching agent which either is an organic peroxyacid or is a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid *in situ* in a bleaching solution formed from the composition; and

(c) from about 0.1% to about 95% by weight of the personal cleansing composition of a surfactant system preferably comprising one or more surfactants selected from the group consisting of anionic carboxylates, amine oxides, alkyl glucosides, glucose amides, alkyl sulfates, alkyl ether sulfates, acyl isethionates, alkyl sulfosuccinates, alkyl phosphate esters, ethoxylated phosphate esters, alkyl glyceryl ether sulfonates and mixtures thereof, more preferably comprising one or more surfactants selected from the group consisting of soaps, acylglutamates, alkyl sarcosinates, lauramine oxides, cocamine oxides, cocamindopropylamine oxides, decylglucosides, lauryl sulfates, laureth sulfates, C₁₂-18 acyl isethionates and mixtures thereof; and

(d) optionally, from about 0.05% to about 50% by weight of the personal cleansing composition of an enzyme stabilizer.

23. The bleaching composition according to Claim 22 wherein said surfactant is soap at a level of at least about 2%, preferably at least about 10%, more preferably at least about 25% by weight of the bleaching composition.

24. The bleaching composition according to Claim 23 wherein the ratio of soap to protease variant is from about 2,000:1 to about 8:1, preferably from about 400:1 to about 40:1.

25. A method for personal cleansing, said method comprising contacting a part of the human or lower animal body in need of cleaning with a bleaching composition according to Claim 22.

26. A method for pretreating a fabric in need of cleaning, said method comprising contacting said fabric prior to washing said fabric with an aqueous solution containing a surfactant with a bleaching composition according to Claims 16 or 17.

27. A bleaching composition comprising:

- (a) an effective amount of a protease variant wherein said protease variant includes a substitution of an amino acid residue with another naturally occurring amino acid residue at one or more amino acid residue positions corresponding to positions 62, 212, 230, 232, 252 and 257 of *Bacillus amyloliquefaciens* subtilisin;
- (b) a bleaching agent which either is an organic peroxyacid or is a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid in situ in a bleaching solution formed from the composition; and
- (c) one or more cleaning adjunct materials.

28. The bleaching composition according to Claim 27 wherein said protease variant is derived from a *Bacillus* subtilisin, preferably *Bacillus lenthus* subtilisin or subtilisin 309.

29. The cleaning composition according to Claim 27 wherein said protease variant includes substitutions of the amino acid residues at one or more of the following positions selected from the group consisting of:

- 1) position 62 and at one or more of the following positions 103, 104, 109, 159, 213, 232, 236, 245, 248 and 252;
- 2) position 212 and at one or more of the following positions 12, 98, 102, 103, 104, 159, 232, 236, 245, 248 and 252;
- 3) position 230 and at one or more of the following positions 68, 103, 104, 159, 232, 236 and 245;
- 4) position 232 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;
- 5) position 232 and at one or more of the following positions 103, 104, 236 and 245;
- 6) positions 232 and 103 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;
- 7) positions 232 and 104 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;
- 8) positions 232 and 236 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;

- 9) positions 232 and 245 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;
- 10) positions 232, 103, 104, 236 and 245 and at one or more of the following positions 12, 61, 62, 68, 76, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 205, 209, 210, 212, 213, 217, 230, 236, 245, 248, 252, 257, 260, 270 and 275;
- 11) position 252 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 12) position 252 and at one or more of the following positions 103, 104, 236 and 245;
- 13) positions 252 and 103 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 14) positions 252 and 104 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 15) positions 252 and 236 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 16) positions 252 and 245 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 17) positions 252, 103, 104, 236 and 245 and at one or more of the following positions 12, 61, 62, 68, 97, 98, 101, 102, 103, 104, 109, 130, 131, 159, 183, 185, 210, 212, 213, 217, 232, 236, 245, 248 and 270;
- 18) position 257 and at one or more of the following positions 68, 103, 104, 205, 209, 210, 232, 236, 245 and 275.

30. The cleaning composition according to Claim 27 wherein said protease variant includes a substitution set selected from the group consisting of:

12/102/103/104/159/212/232/236/245/248/252; 61/68/103/104/159/232/236/245/248/252;
62/103/104/130/159/213/232/236/245/248/252; 62/103/104/159/213/232/236/245/248/252;
62/103/104/109/159/213/232/236/245/248/252; 62/103/104/159/232/236/245/248/252;
62/101/103/104/159/212/213/232/236/245/248/252;
68/103/104/159/232/236/245/248/252/270;
68/103/104/159/185/232/236/245/248/252; 68/103/104/159/210/232/236/245/248/252;

68/103/104/159/185/210/232/236/245/248/252; 68/103/104/159/213/232/236/245/248/252;
68/103/104/159/230/232/236/245; 68/76/103/104/159/209/232/236/245;
68/103/104/232/236/245/248/257/275; 68/103/104/213/232/236/245/248/252;
68/103/104/159/232/236/245/248/252; 68/103/104/159/209/232/236/245;
68/76/103/104/159/232/236/245; 68/103/104/159/232/236/245/257;
68/103/104/159/232/236/245; 68/103/104/159/232/236/245/257;
68/76/103/104/159/211/232/236/245; 68/76/103/104/159/215/232/236/245;
68/103/104/159/210/232/236/245; 68/103/104/159/213/232/236/245/260;
68/76/103/104/159/213/232/236/245/260; 68/76/103/104/159/210/232/236/245/260;
68/103/104/159/183/232/236/245/248/252; 68/103/104/232/236/245/257/275;
68/103/104/159/213/232/236/245; 76/103/104/159/232/236/245;
76/103/104/159/213/232/236/245/260; 76/103/104/131/159/232/236/245/248/252;
97/103/104/159/232/236/245/248/252; 98/103/104/159/232/236/245/248/252;
98/102/103/104/159/212/232/236/245/248/252; 101/103/104/159/232/236/245/248/252;
102/103/104/159/232/236/245/248/252; 103/104/159/232/236/245;
103/104/159/248/252/270; 103/104/159/232/236/245/248/252;
103/104/159/205/209/232/236/245/257 103/104/159/232/245/248/252;
103/104/159/205/209/210/232/236/245/257; 103/104/159/213/232/236/245/248/252;
103/104/159/217/232/236/245/248/252; 103/104/130/159/232/236/245/248/252;
103/104/131/159/232/236/245/248/252; 103/104/159/205/209/232/236/245; and
103/104/159/232/236/245/257.

31. The cleaning composition according to Claim 30 wherein said protease variant includes a substitution set selected from the group consisting of:

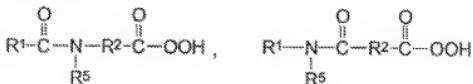
12R/102A/103A/104I/159D/212G/232V/236H/245R/248D/252K;
61E/68A/103A/104I/159D/232V/236H/245R/248D/252K;
62D/103A/104I/109R/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/213R/232V/236H/245R/248D/252K;
62D/103A/104I/159D/232V/236H/245R/248D/252K;
62D/103A/104I/130G/159D/213R/232V/236H/245R/248D/252K;
62D/101G/103A/104I/159D/212G/213R/232V/236H/245R/248D/252K;
68A/76D/103A/104I/159D/213R/232V/236H/245R/260A;
68A/76D/103A/104I/159D/210I/232V/236H/245R/260A;
68A/103A/104I/159D/183D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/209W/232V/236H/245R;
68A/76D/103A/104I/159D/211R/232V/236H/245R;
68A/76D/103A/104I/159D/215R/232V/236H/245R;

68A/103A/104I/159D/213R/232V/236H/245R/260A;
68A/76D/103A/104I/159D/232V/236H/245R;
68A/103A/104I/159D/232V/236H/245R/252K;
68A/103A/104I/159D/232V/236H/245R;
68A/103A/104I/159D/232V/236H/245R/257V;
68A/103A/104I/159D/185D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/210L/232V/236H/245R/248D/252K;
68A/103A/104I/159D/185D/210L/232V/236H/245R/248D/252K;
68A/103A/104I/159D/213E/232V/236H/245R/248D/252K;
68A/103A/104I/159D/230V/232V/236H/245R;
68A/76D/103A/104I/159D/209W/232V/236H/245R;
68A/103A/104I/232V/236H/245R/248D/257V/275H;
68A/103A/104I/232V/236H/245R/257V/275H;
68A/103A/104I/213E/232V/236H/245R/248D/252K;
68A/103A/104I/159D/232V/236H/245R/248D/252K;
68A/103A/104I/159D/210I/232V/236H/245R;
68A/103A/104I/159D/210L/232V/236H/245R;
68A/103A/104I/159D/213G/232V/236H/245R;
68A/103A/104I/159D/232V/236H/245R/248D/252K/270A;
76D/103A/104I/159D/232V/236H/245R;
76D/103A/104I/131V/159D/232V/236H/245R/248D/252K;
76D/103A/104I/159D/213R/232V/236H/245R/260A;
97E/103A/104I/159D/232V/236H/245R/248D/252K;
98L/103A/104I/159D/232V/236H/245R/248D/252K;
98L/102A/103A/104I/159D/212G/232V/236H/245R/248D/252K;
101G/103A/104I/159D/232V/236H/245R/248D/252K;
102A/103A/104I/159D/232V/236H/245R/248D/252K;
103A/104I/159D/232V/236H/245R/248D/252K;
103A/104I/159D/213R/232V/236H/245R/248D/252K;
103A/104I/130G/159D/232V/236H/245R/248D/252K;
103A/104I/159D/217E/232V/236H/245R/248D/252K;
103A/104I/159D/248D/252K/270V;
103A/104I/159D/232V/236H/245R;
103A/104I/159D/205I/209W/232V/236H/245R/257V;
103A/104I/159D/232V/236H/245R/257V;
103A/104I/131V/159D/232V/236H/245R/248D/252K;

103A/104I/159D/205I/209W/210I/232V/236H/245R/257V; and
103A/104I/159D/232V/245R/248D/252K.

32. The bleaching composition according to Claim 27 wherein said bleaching agent is selected from the group consisting of:

(i) an organic peroxyacid selected from the group consisting of organic peroxyacids of the formula:



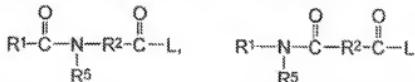
wherein R^1 is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R^2 is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, and R^5 is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms; E-phthalimido peroxycaproic acids; and mixtures thereof; and

(ii) a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid in situ in a bleaching solution formed from the composition, wherein said bleach activator has the general formula:



wherein R is an alkyl group containing from about 5 to about 18 carbon atoms wherein the longest linear alkyl chain extending from and including the carbonyl carbon contains from about 6 to about 10 carbon atoms and L is a leaving group, the conjugate acid of which has a pKa in the range of from about 4 to about 13;

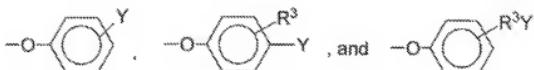
preferably said bleach activator has the general formula:



or mixtures thereof, wherein R^1 is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R^2 is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, R^5 is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms, and L is a leaving group;

more preferably R^1 is an alkyl group containing from about 6 to about 12 carbon atoms, R^2 contains from about 1 to about 8 carbon atoms, and R^5 is H or methyl.

33. The bleaching composition according to Claim 32 wherein R¹ is an alkyl group containing from about 7 to about 10 carbon atoms, R² contains from about 4 to about 5 carbon atoms, and wherein L is selected from the group consisting of:

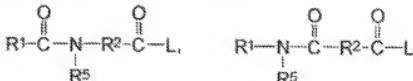


wherein R³ is an alkyl chain containing from about 1 to about 8 carbon atoms, and Y is -SO₃⁻M⁺ or -CO₂⁻M⁺ wherein M is sodium or potassium.

34. The bleaching composition according to Claim 27 wherein said bleaching agent comprises a bleach activator selected from the group consisting of tetraacetyl ethylene diamine (TAED), benzoylcapro lactam (BzCL), 4-nitrobenzoylcapro lactam, 3-chlorobenzoylcapro lactam, benzoyloxybenzenesulphonate (BOBS), nonanoyloxybenzenesulphonate (NOBS), phenyl benzoate (PhBz), decanoxyloxybenzenesulphonate (C₁₀-OBS), benzoylvalerolactam (BZVL), octanoyloxybenzenesulphonate (C₈-OBS), perhydrolyzable esters, 4-[N-(nacetyl) amino hexanoyloxy]-benzene sulfonate sodium salt (NACA-OBS), lauryloxybenzenesulphonate (LOBS or C₁₂-OBS), 10-undecenoyloxybenzenesulfonate (UDOBS or C₁₁-OBS with unsaturation in the 10 position), and decanoxybenzoic acid (DOBA) and mixtures thereof, and further optionally comprises a bleach catalyst, preferably 3-(3,4-dihydroisoquinolinium) propane sulfonate.

35. The bleaching composition according to Claim 27 wherein said bleaching agent comprises at least about 0.1% by weight of the bleaching agent of a peroxygen bleaching compound capable of yielding hydrogen peroxide in an aqueous liquor and at least 0.1% by weight of the bleaching agent of one or more bleach activators, wherein said bleach activators are members selected from the group consisting of:

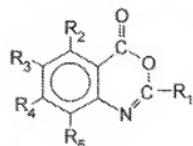
a) a bleach activator of the general formula:



or mixtures thereof, wherein R¹ is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R² is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, R⁵ is H or an alkyl, aryl, or alkaryl group containing

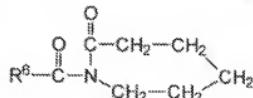
from about 1 to about 10 carbon atoms, and L is a leaving group;

b) a benzoxazin-type bleach activator of the formula:



wherein R1 is H, alkyl, alkaryl, aryl, arylalkyl, and wherein R2, R3, R4, and R5 may be the same or different substituents selected from H, halogen, alkyl, alkenyl, aryl, hydroxyl, alkoxy, amino, alkylamino, -COOR₆, wherein R₆ is H or an alkyl group and carbonyl functions;

c) a N-acyl caprolactam bleach activator of the formula:



wherein R⁶ is H or an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to 12 carbons; and

d) mixtures of a), b) and c).

36. The bleaching composition according to Claim 27 wherein the corresponding carboxylic acid of the organic peroxyacid bleaching agent has a Hydrophilic-Lipophilic Balance value within the range of from about 3 to about 6.5.

37. The bleaching composition according to Claim 27 wherein said cleaning adjunct materials are selected from the group consisting of surfactants, solvents, buffers, enzymes, soil release agents, clay soil removal agents, dispersing agents, brighteners, suds suppressors, fabric softeners, suds boosters, enzyme stabilizers, builders, other bleaching agents, dyes, perfumes, chelants and mixtures thereof.

38. The bleaching composition according to Claim 37 wherein said cleaning adjunct materials comprise at least one deterutive surfactant, preferably a branched surfactant, more preferably a mid-chained branched surfactant.

39. The bleaching composition according to Claim 37 wherein the cleaning adjunct materials comprise at least about 0.1% surfactant by weight of the composition, said

surfactant comprising materials selected from the group consisting of alkyl benzene sulfonates, primary alkyl sulfates, secondary alkyl sulfates, alkyl alkoxy sulfates, alkyl alkoxy carboxylates, alkyl polyglycosides and their corresponding sulfated polyglycosides, alpha-sulfonated fatty acid esters, alkyl and alkyl phenol alkoxylates, betaines and sulfobetaines, amine oxides, N-methyl glucamides, nonionic primary alcohol ethoxylates, nonionic primary alcohol mixed ethoxy/propoxy, and mixtures thereof.

40. The bleaching composition according to Claim 39 further comprising at least about 5% builder selected from the group consisting of zeolites, polycarboxylates, layered silicates, phosphates, and mixtures thereof.

41. The bleaching composition according to Claim 37 wherein said cleaning adjunct materials comprise at least one detergents enzyme selected from the group consisting of cellulases, lipases, amylases, phospholipases, other proteases, peroxidases and mixtures thereof.

42. The bleaching composition according to Claim 27 wherein said bleaching composition is a fabric bleaching composition, preferably in the form of a liquid, granule, tablet, powder or bar, comprising at least about 5% surfactant and at least about 5% builder by weight of the composition.

43. The bleaching composition according to Claim 27 wherein said bleaching composition is a fabric bleaching composition comprising:

- (a) from about 0.0001% to about 10% by weight of said protease variant;
- (b) from about 0.5% to about 20% by weight of said bleaching agent;
- (c) at least about 5% by weight of a surfactant preferably selected from the group consisting of alkyl benzene sulfonates, primary alkyl sulfates, secondary alkyl sulfates, alkyl alkoxy sulfates, alkyl alkoxy carboxylates, alkyl polyglycosides and their corresponding sulfated polyglycosides, alpha-sulfonated fatty acid esters, alkyl and alkyl phenol alkoxylates, betaines and sulfobetaines, amine oxides, N-methyl glucamides, nonionic primary alcohol ethoxylates, nonionic primary alcohol mixed ethoxy/propoxy, and mixtures thereof; and
- (d) at least about 5% by weight of a builder preferably selected from the group consisting of zeolites, polycarboxylates, layered silicates, phosphates, and mixtures thereof.

44. The bleaching composition according to Claim 43 is in the form of a concentrated granular fabric bleaching composition comprising at least about 15% surfactant.

45. A method for cleaning fabric, said method comprising contacting a fabric in need of cleaning with a bleaching composition according to Claims 42 or 43.

46. The bleaching composition according to Claim 27 wherein said bleaching composition is a dishwashing bleaching composition, preferably in the form of a liquid, granule, powder or tablet, comprising:

- (a) from about 0.0001% to about 10% by weight of the dishwashing bleaching composition of said protease variant;
- (b) from about 0.5% to about 20% by weight of the dishwashing bleaching composition of said bleaching agent
- (c) from about 0.1% to about 10% by weight of the dishwashing bleaching composition of a surfactant.

47. A method for cleaning dishes, said method comprising contacting a dish in need of cleaning with a bleaching composition according to Claim 46.

48. A personal cleansing composition comprising:

- (a) from about 0.001% to about 5%, preferably from about 0.001% to about 2%, more preferably from about 0.01% to about 0.8% by weight of the personal cleansing composition of a protease variant wherein said protease variant includes a substitution of an amino acid residue with another naturally occurring amino acid residue at one or more amino acid residue positions corresponding to positions 62, 212, 230, 232, 252 and 257 of *Bacillus amyloliquefaciens* subtilisin;
- (b) from about 0.5% to about 20% by weight of the personal cleansing composition of a bleaching agent which either is an organic peroxyacid or is a combination of a bleach activator and a peroxygen compound capable of yielding hydrogen peroxide that can react with the activator to form an organic peroxyacid in situ in a bleaching solution formed from the composition; and
- (c) from about 0.1% to about 95% by weight of the personal cleansing composition of a surfactant system preferably comprising one or more surfactants selected from the group consisting of anionic carboxylates, amine oxides, alkyl glucosides, glucose amides, alkyl sulfates, alkyl ether sulfates, acyl isethionates, alkyl sulfosuccinates, alkyl phosphate esters, ethoxylated phosphate esters, alkyl glyceryl ether sulfonates and mixtures thereof, more preferably comprising one or more surfactants selected from the group consisting of soaps, acylglutamates, alkyl sarcosinates, lauramine oxides, cocamine oxides,

cocamindopropylamine oxides, decylglucosides, lauryl sulfates, laureth sulfates, C₁₂-18 acyl isethionates and mixtures thereof; and

(d) optionally, from about 0.05% to about 50% by weight of the personal cleansing composition of an enzyme stabilizer.

49. The bleaching composition according to Claim 48 wherein said surfactant is soap at a level of at least about 2%, preferably at least about 10%, more preferably at least about 25% by weight of the bleaching composition.

50. The bleaching composition according to Claim 49 wherein the ratio of soap to protease variant is from about 2,000:1 to about 8:1, preferably from about 400:1 to about 40:1.

51. A method for personal cleansing, said method comprising contacting a part of the human or lower animal body in need of cleaning with a bleaching composition according to Claim 48.

52. A method for pretreating a fabric in need of cleaning, said method comprising contacting said fabric prior to washing said fabric with an aqueous solution containing a surfactant with a bleaching composition according to Claims 42 or 43.

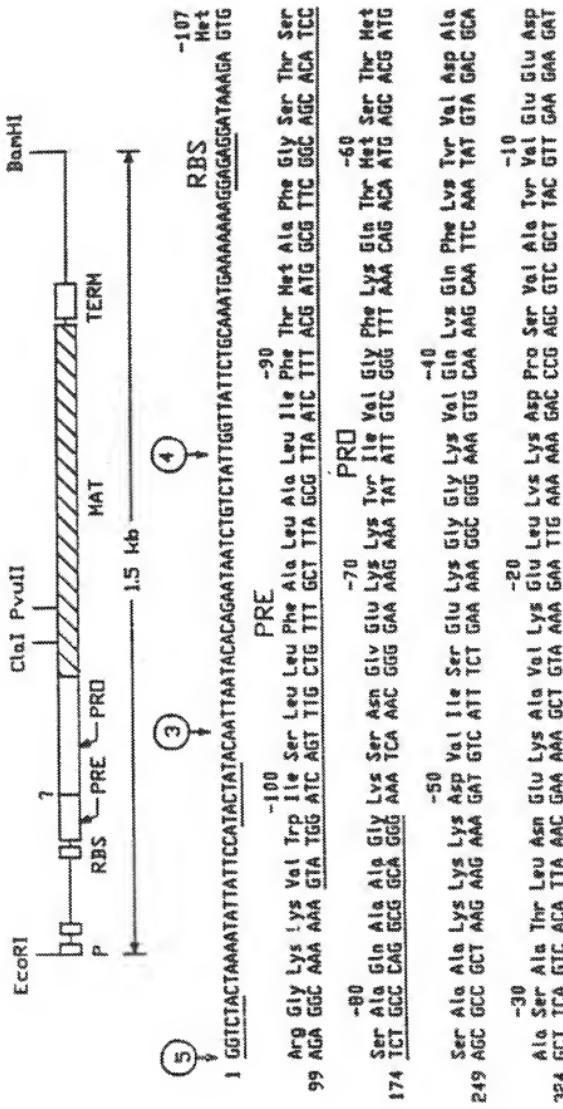


FIG.-1A

→ MAT

His Val Ala His Ala Tyr Ala Gln Ser Val Pro Tyr Gly Val Ser Gln Ile Lys Ala Pro Ala Leu His Ser Gln 399 CAC GIA GCA CAT GCG TAC GCG CAG TCC GTC GIG CCT TAC GGC GIA TCA CAA ATT AAA GCC CCT GCT CTG CAC TCT CAA	10 GLY Tyr Thr GLY Ser Asn Val Lys Val Ile Asp Ser Gln Ile Asp Ser Ser His Pro Asn Leu Ivs Val 40 474 GGC TAC ACT GGA TCA ATT GTT AAA GTA GCG GTT ATC GAC AGC GGT ATC GAT TCT TCT CAT CCT GAT TTA AAG GIA	20 Ala GLY GLY Ala Ser Met Val Pro Ser Gln Thr Asn Pro Phe Gln Asp Asn Ser His Gln Thr His Val Ala 549 GCA AGC GGA GCC AGC ATG GTT CCT TCT GAA ACA ATT CCT TIC CAA GAC AAC TCT AAC GAC AAC TCT AAC GTC GTT GCC	30 50 60 70 80 90	40 Pro Asn 60 Asp Ser Ala Pro Ser Ala Ser Leu Tyr Ala Val Lys 624 GGC ACA GTT GCG GCT CCT ATT AAC TCA ATC GGT GIA TTA GCG GTT GCG CCA AGC GCA TCA CCT TAC GCT GTA AAA	GLY Thr Val Ala Ala Leu Asn Asn Ser Ile Gln Val Leu Gln Val Ala Pro Ser Ala Ser Leu Tyr Ala Val Lys Asp Ala 100 Val Leu GLY Ala Asp GLY Ser GLY Gln Tyr Ser Trp Ile Ile Asn Gln Ile Glu Trp Ala Ile Asn Asn Het 699 GTT CTC GGT GCT GAC GGT TCC GGC CAA TAC AGC TGG ATC ATT AAC GGA ATC GAG TGG GCG ATC GCA AAC AAT ATG	100 110 120 130 140	50 60 70 80 90	110 120 130 140 150	10 20 30 40 50	10 20 30 40 50	10 20 30 40 50
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Asp Val Ile Asn Het Ser Leu Gln GLY Pro Ser Gln Ser Ala Ala Val Asp Ivs Ala Val Ala
 774 GAC GTT ATT AAC ATG AGC CTC GTC GGC GGA CCT TCT GGT TCT GCT GCT TTA AAA GCG GCA GTT AAA GCG GTC GTT GCA
 Ser GLY Val Val Val Val Ala Ala Ala Ala Gln Asn Gln GLY GLY Ser GLY Ser Ser Ser Thr Val GLY Ivr Pro GLY
 849 TCC GGC GTC GIA GTC GTT GCG GCA GGC GGT AAC GAA GGC ACT TCC GGC AGC ACA TCA AGC TAC CCT GGT

FIG-1B

170 Lys Tyr Pro Ser Val Ile Ala Val Glv Ala Val Asp Ser Ser Asn Gln Arg Ala Ser Phe Ser Ser Val Glv Pro
 924 AAA TAC CCT TCT GTC ATT GCA GAA GGC GTC ATT GCA GAA GCA AGC AAC CAA AGA GCA TCT TIC TCA AGC GIA GGA CCT

180

190 Lys Tyr Pro Ser Val Ile Ala Val Glv Ala Val Asp Ser Ser Asn Gln Arg Ala Ser Phe Ser Ser Val Glv Pro

200 Glu Leu Asp Val Met Ala Pro Gly Val Ser Ile Gln Ser Thr Leu Pro Glv Asn Lys Tvr Gly Ala Tvr Asn Glv

999 GAG CTT GAT GTC ATG GCA CCT GGC GIA TCT ATC CAA AGC AUG CTT CCT GGA AAC AAA TAC GCG TAC AAC GGT

210

220 Thr Ser Met Ala Ser Pro His Val Ala Ala Leu Ile Leu Ser Lys His Pro Asn Trp Thr Asn Thr

1074 ACG TCA ATG GCA TCT CGC CAC GTT GCC GGA GCG GCT GCT TIG ATT CCT TCT AAC CCG AAC TGG ACA AAC ACT

230

240 Thr Ser Met Ala Ser Pro His Val Ala Ala Leu Ile Leu Ser Lys His Pro Asn Trp Thr Asn Thr

250 Gln Val Aro Ser Ser Leu Glu Asn Thr Thr Lys Leu Glv Asp Ser Phe Tyr Tyr Lys Glv Leu Ile Asn

11149 CAA GTC CGC ACG AGT TTA GAA AAC ACC ACT ACA AAA CTT GGT GAT TCT TIG TAC TAT GGA AAA EGG CTG ATC AAC

260

270 Val Gln Ala Ala Ala Gln DC

1224 GTA CAA GCG GCA GCT CAG TAA AACATAAAAACCCGGCTTGTGTTTCTCCGGCATGTCATAACCGCTC

TERM

11316 ATATTCACGGATGGCTTCCCTTGAAATTTCAGAGAAACGGGGGTGACCGCAACTCTGAAACGCTCAA1GCC

416 CTTCCCGTTCCTGAGCTCAATGGCTAAACGTTAACGGTACCGGATCTGTAATCGTAT

EIGEN

CONSERVED RESIDUES IN SUBLISING FROM
BACILLUS AMYLOLIQUEFACTENS

1		10																		
A	Q	S	V	P	.	G	.	.	.	.	.	A	P	A	,	H	.	.	G	
21																				
.	T	G	S	.	V	E	K	V	A	V	.	D	.	G	.	.	.	H	P	
41																				
D	L	.	.	.	G	G	A	S	.	V	P	.	.	.	.	.	Q	D		
61																				
.	N	.	H	G	T	H	V	A	G	T	.	A	A	L	N	N	S	I	G	
81																				
V	L	G	V	A	P	S	A	.	L	Y	A	V	K	V	L	G	A	.	G	
101																				
S	G	.	.	S	.	L	.	.	G	.	E	W	A	.	N	.	.	.		
121																				
V	.	N	.	S	L	G	.	P	S	.	S	.	.	.	.	A	.	.		
141																				
.	.	.	.	.	G	V	.	V	V	A	A	.	G	N	.	G	.	.		
161																				
.	.	.	.	.	Y	P	.	.	Y	.	.	.	A	V	G	A	.			
181																				
D	.	.	N	.	.	A	S	F	S	.	.	G	.	.	L	D	.	A		
201																				
P	G	V	.	.	Q	S	T	.	P	G	.	.	Y	.	.	.	N	G	T	
221																				
S	M	A	.	.	P	H	V	A	G	A	A	A	L	.	.	.	K	.	.	
241																				
W	.	.	Q	.	R	.	L	.	N	T	.	.	.	L	G	.	.			
261																				
.	.	Y	G	.	G	L	.	H	.	A	A	.	.							

FIG. 2

Comparison of subtilisin sequences from:

B.amyloliquifaciens

B.subtilis

B.licheniformis

B.lentus

01	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
AQ S V P Y G V S Q I K A P A L H S Q G Y T G S N V K V A V I D S G I D S S H P	AQ S V P Y G C I S Q I K A P A L H S Q G Y T G S N V K V A V I D S G I D S S H P	AQ T V P Y C I P L I K A D K V Q A Q G F K G A H V K V U L D T G I Q A S H P	AQ S V P W G I S R V Q A P A H N R G I T G S G V K V A V L D T G I S T * H P	D L K V A G G C A S H V U P S E T N P F Q D M N N S H G T H V A G T V A A L H N S I G	D L N V R G G A S F V P S E T N P Y Q D G S S H G T H V A G T V A A L H N S I G	D L N V V G G A S F V A G E A Y N A T D C G N G H G T H V A G T V A A L D N T I G	D L N I R G G A S F V P G E * P S T Q D C G N G H G T H V A G T V A A L N S I G	V L G V A P S A S L Y A V K V L G A D G S G Q Y S H I I N G I E W A I A N N N D	V L G V S P S A S L Y A V K V L D S T G S G Q Y S H I I N G I E W A I S N N D	V L G V A P S V A E L Y A V K V L N S G S G S V S G I V S G I E W A T T N G N D	V L G V A P S A E L Y A V K V L G A S G S V S S I A Q C L E W A G H N G N H	V I N N S L G G P S G E A A L K A A V D K A V A S G V V V A A A G H E G T S G	V I N N S L G G P T G S G E S T A L K T V V D K A V A S S G I V V A A A G H E G S S C	V I N N S L G G A S G S T A N K K O A V D N A Y A R G V V V A A A G N S G H S C	V A N N S L G S P S P S A T L E Q A V N S A T S R G V L V V A A S G N S G A C S

FIG 3/A

161 S S S T V G Y P G K Y P S V I A V G A V D S S N Q R A S F S S V C G P E L D V M A S T S T V G Y P A K Y P S T I V A V G A V D S N S N Q R A S F S S V C G A E L D V M A * * * I S Y P A R Y A N A M A V G A T D Q N N H R A S F S Q Y C A G L D I V A	170 P G V S I Q S T L P G N K Y G A Y N G T S H A T P H V A G A A A L I L S K H P N P G V S I Q S T L P P G G T Y G A Y N G T A L N G T S M A S P H V A G A A A L I L S K H P T P G A G V Y S T Y P T N T Y A T L N G T S M A S P H V A G A A A L I L S K H P H P G V N V Q S T Y P G S T Y A S L N G T S M A T P H V A G A A A L V R Q K N P S	180 210 220 230
190		
201 210 220 230		
241 250 260 270		
	W T H T Q V R S S L E N T T K L G D S F Y Y G K G L I N V Q A A A Q W T H A Q V R D R L E S S T A T Y L G N S F Y Y G K G L I N V Q A A A Q L S A S Q V R N R L S S T A T Y L G S S F Y Y G K G L I N V E A A A Q W S N V Q I R N H L K N T A T S L G S T H L Y G S G L V N A E A A T R	

FIG 3/B

INTERNATIONAL SEARCH REPORT

Int'l. Application No.
PCT/US 98/22482

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C11D3/386 C12N9/54 A61K7/48 A61K7/28 C11D3/39

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C11D C12N A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronically based consulted during the International search terms of data base and, where practical, search terms used

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Character of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 10592 A (PROCTER & GAMBLE) 20 April 1995 see claims see examples see table 3 see page 50, line 13 - line 30	1,2, 6-19,26
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A	see examples 19,28-34,40,41-45, 62-65	22-24,
X	-& US 5 677 272 A (PROCTER & GAMBLE) 14 October 1997 cited in the application see abstract	48-51 1
		-/-

Further documents are listed in the continuation of box C

Patient family members are listed in annex

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual conclusion of the international search

Date of mailing of the international search report

24 March 1999

06/04/1999

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx. 31 651 epc nl
Fax (+31-70) 340-3616

Authorized officer

Neys, P

INTERNATIONAL SEARCH REPORT

International Application No

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A	see page 68, line 37 - page 73, line 12 -----	30,31
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